

ENGINEERING DIVISION WORKING COPY
RETURN TO FILE

RESUME REPORT
ON THE HURRICANES OF
AUGUST 31, 1954
AND
SEPTEMBER 11, 1954
IN THE
COASTAL REGION OF NEW ENGLAND

DECEMBER 8, 1954

CORPS OF ENGINEERS

U. S. ARMY

OFFICE OF THE DIVISION ENGINEER

NEW ENGLAND DIVISION

BOSTON, MASS.

Coastal Damages -- Hurricane Carol

General. -- Information concerning coastal damages was obtained from newspaper accounts and spot inspection of all seriously damaged areas. All quantitative data, such as monetary estimates of losses and numbers of buildings and boats damaged or destroyed are as reported in the press. Most of these figures were printed within a few days of the hurricane and are therefore obviously preliminary in nature and subject to inaccuracy. Information obtained from the field inspections indicated locations and nature of damages sustained. This information was used as a guide in selecting and interpreting news accounts of damages used in the following paragraphs and in many instances it supplemented those accounts.

New England (General). - Coastal damages from Hurricane Carol

occurred generally throughout New England. The amount and type of damages varied considerably. The eastern seaboard from Chatham, Massachusetts northward facing the Atlantic Ocean, Cape Cod Bay, Massachusetts Bay and the Gulf of Maine generally escaped serious damages to shore structures, dwellings and waterfront facilities or serious erosion of beaches attributable to wave attack. Damages to pleasure and commercial craft and to fishing and lobster gear were widespread and costly throughout New England as was flooding from the exceptionally high tides. The shore areas extending westward from Chatham along Nantucket and Vineyard Sounds, Buzzards Bay, Narragansett Bay, Block Island Sound, Fishers Island Sound and Long Island Sound received the brunt of the hurricane attack. The most serious damages occurred along the shore of Connecticut east of the Connecticut River, the entire coast of Rhode Island and the Buzzards Bay and Vineyard Sound shores of Massachusetts. Damages west of the Connecticut River and along the eastern part of the south shore of Cape Cod were moderate compared to other areas consisting largely of flooding low areas and damages to boats. No estimate is available of coastal damages along. Total losses, including all damages, inland as well as coastal, have been reported in the

press as being about \$500,000,000.

Connecticut. - Damages resulting from flooding occurred at low shore areas throughout Connecticut. Damages from wave attack were particularly severe only east of the Connecticut River and they increased in severity towards the Rhode Island boundary with the greatest damages in the town of Stonington. Some damages due to wave attack also occurred between New Haven and the Connecticut River at developments which were particularly vulnerable because of their locations at low beach areas. Erosion of beaches and destruction of sea walls and other shore protection structures were not generally severe. At some locations quantities of sand were washed landward from low beaches. At others sandy beaches appeared to have benefitted by accretion. The greater part of all losses throughout the state resulted from water damage to industrial plants, business establishments, shorefront homes and cottages and east of the Connecticut River from damages to fishing and pleasure boats and harbor facilities and physical destruction of shorefront homes and cottages and bathing beach establishments. Estimates of losses are available for only a few towns or locations within the towns. This information indicates that coastal damages probably exceeded \$10,000,000. One report covering single homes only claimed that 100 were destroyed, 232 received major damage and 190 minor damage. Another report claimed 1889 boats and 129 automobiles ruined or damaged east of New Haven. The character and extent of damages are indicated in the following

paragraphs.

Greenwich, Connecticut. - Most shore damages resulted from flooding due to the high tide. A newspaper reported \$1,000,000 damages based on an estimate by utility and town officials. Very little damage was evident during an inspection of the shore made immediately after the hurricane. Reported locations of and nature of damages were as follows:

- a. Bruce, Byron and Binney Parks. - Badly hit.
- b. Greenwich Point and Lucas Point. - Badly hit.
- c. Greenwich Harbor. - Heavy damage to lumber and sand at Maher Bros. Corp.
- d. Island Beach. - Completely submerged.
- e. Yacht Clubs. - Badly hit.

Stamford, Connecticut. - Flooding of low shore areas occurred due to sudden rising of the tide after passage of the storm. The southern part of Shippagan Point was heaviest hit. The South End was also flooded. No monetary estimate of damages is available.

Norwalk, Connecticut. - Flooding occurred as a result of high tides, reported as being of record height. Shorehaven, Harbor View, Bell Island, Shorefront Park and parts of Rowayton reportedly became isolated islands with considerable damage to flooded homes. No monetary estimate of damages is available.

Milford, Connecticut. - Beach areas were reportedly hard hit, presumably from the exceptionally high tide with heavy damages to homes and roads. General mobilization was sounded and several hundred persons were evacuated from West Shore areas and from Point Beach, Pond Point, Bayview and Woodmont. No monetary estimate of damages is available.

West Haven, Connecticut. - Tidal flooding of low beach areas ^{noted} were reported with portions of First Avenue, Beach Street, Ocean Avenue, Savin Avenue and the smaller streets in the western part of Savin Rock under water. Families were evacuated from Bradley Point. Cabanas were destroyed on Wilcox (West Haven) Beach located in the Savin Rock section. Boats were damaged, destroyed or sunk along Sandy Beach, at Sandy Point Boat Club and in New Haven Harbor. No monetary estimate of damages is available.

New Haven, Connecticut. - The Morris Cove section of New Haven Harbor was hit hard. Winds and tides reportedly smashed homes and porches, ripped piers, beached boats and littered the shore with debris. Houses lost

walls and had their cellars flooded. A cabin cruiser and 13 other boats were reported lost. No monetary estimate of damages is available.

East Haven, Connecticut. - Silver Sands, ^WMamaquid and Mansfield Beaches ~~were~~ reportedly received a brutal pounding with cottages splintered, roads and walks washed away and low shore areas inundated. No monetary estimate of damages is available.

Branford, Connecticut. - Reported damages consisted principally of flooding at Pine Orchard and Stony Creek and damage to a dock at Stony Creek. No monetary estimate of damages is available.

Madison, Connecticut. - Damages resulted principally from flooding accompanying the exceptionally high tide. Reported damages were as follows:

- a. Circle Beach. Road washed out. Cottages inundated.
- b. East and West Wharfs. Flooded.
- c. Madison Beach Club. Middle Beach Area. Guests and families evacuated.
- d. Hammonasset Beach. High water extended one-half mile inland causing extensive damage to trailers, tents and portable houses of campers. Sand covered the parking area and Meigs Point Road, the latter to an average depth of 18 inches. The landward edge of the sand beach was reportedly extended about 40 feet inland over the marsh with an average

depth of sand of one foot.

No monetary estimate of damages is available.

Clinton, Connecticut. Damages reported in the Clinton Harbor area consisted of destruction of many of the smaller buildings at the John Ek Boat Works. Large and small boats in the harbor took a severe beating. Families marooned on Cedar Island by the high tide were rescued.

^{West}
Waterbrook, Connecticut. The high tide reportedly floated 20 or 30 cottages from the West Beach (Coral Sands) area around the marshes. The shore road along West Beach was covered with sand. No monetary estimate of damages is available.

Old Saybrook, Connecticut. Widespread damages occurred principally as a result of flooding caused by the exceptionally high tide. Cottages were floated away, automobiles were under water and water damage occurred to personal belongings. People were evacuated by boat from Chalker Beach. Damages were reported at Chalker Beach, Indiantown, Great Hammock Beach and at Fenwick with the hardest hit area between Oyster River and Cornfield Point. Damages were also reported to the causeway bridge, presumably at South Cove. No monetary estimate of damages is available.

Old Lyme, Connecticut. Costly damages occurred as a result of flooding caused by the high tide and from wind and wave attack. Reported

damages were as follows:

- a. White Sands Beach. Several cottages were demolished and the shore road behind the west end of the beach was covered with sand.
- b. Old Lyme Beach Club. One wing was separated from the main building, the porch buckled, the pier scattered, the road torn up and covered with sand and debris.
- c. Hawks Nest Beach. Six stone groins were damaged, principally at their inshore ends, requiring repairs estimated at \$2500. It was estimated that 10,000 cubic yards of beach sand was carried over the road into the marsh to the north. The tide reached a height approximately 3 inches lower than the previous record high. Some cottages were damaged or moved from their foundations. Damages to private property were reportedly estimated as \$39,192.
- d. Point O'Woods. Concrete and stone walls and boardwalks were damaged. Between 20 and 25 cottages were destroyed or badly damaged while many others suffered from wind or water. Beach sand was washed landward.

Damages to all private beachfront property in the town were estimated at \$106,000.

East Lyme, Connecticut. Damages occurred from tidal flooding and wave attack reported as follows:

- a. Giants Neck. Portions of shore road undermined.
- b. Black Point Beach. Fleet and decking ripped from light pier. Minor damage to bathhouse.
- c. Black Point. Slight erosion behind sea walls along south end of Point. Damage negligible.
- d. Oak Grove, Niantic. Fronts of about a dozen cottages ripped off by seas. Front and rear of some cottages gone leaving just a shell. Boats beached, damaged or sunk.
- e. Attawan Beach. Shore road washed out.
- f. Crescent Beach. Damage to concrete sea wall and steps and erosion along the south end of beach. Some damage to buildings along the north end of the beach.

Accretion of about 6 inches were reported along Black Point Beach and all but the south end of Crescent Beach.

No monetary estimate of damages available.

Waterford, Connecticut. -

Harkness Memorial State Park. Beach sand was washed landward covering the parking area and approach road. Boulder revetment was torn apart at the west end of the bathing beach. Bathhouses were moved from their foundations.

No monetary estimate of damages available.

New London, Connecticut. - Damages were estimated as \$1,000,000. Reports indicate that most of this was water damage from tidal flooding or damages to boats. Reported damages were as follows:

- a. Ocean Beach. The water level was up to the boardwalk inundating meters in the filter room basement. Chain link fences were knocked down and the steel float drifted into Alewife Cove. Estimated damages to amusements was \$36,000.
- b. Osprey Beach. Bathhouse was wrecked.
- c. Pequot Avenue and Neptune Park. Shore residences received the brunt of the storm.
- d. New London Harbor. About 40 boats, 20 to 60 feet long were reported as total losses and at least 100 boats ranging from skiffs to Lightnings and fair sized cruisers were swamped.
- e. Bank Street, Water Street, Union Station. Inundated. Water damage to stock in business establishments. - 8 -

Groton, Connecticut. - The town of Groton sustained severe damages resulting from wind, wave attack and the exceptionally high tide (reported as 9.5 feet above mean low water at 11:55 A.M. - probably Daylight Saving Time). Reported damages were as follows:

- a. Griswold Hotel Cove. 100-foot strip of pier dropped across the shore road.
- b. Shenecossett Beach. The beach club was wiped out, bathhouses badly damaged. its many cabanas split into sections. Portions of wood frame bathhouse were scattered about.
- c. Avery Point. Estimated \$14,000 damage at the United States Coast Guard Training Station consisting of bank erosion of 5 to 25 feet, damage to riprap revetment and to roads and buildings. A rubble masonry sea wall was breached.
- d. Jupiter Point. Cottages were carried from their foundations with four destroyed and others damaged.
- e. Groton Long Point. Seas topped sea walls, flooded and damaged cottages, tore up the shore road, smashed piers and littered the area with debris. A small fleet of boats was submerged and the boardwalk at the main bathing beach was destroyed. Shoaling occurred at the Venetian Harbor entrance.

f. Neank. Town dock and some private fishing docks in the immediate area were smashed. Scores of small boats were grounded. Tide above 7 feet above normal occurred about one hour after climax of the hurricane, flooding homes and wells.

g. Ram Island Yacht Club. Only 3 or 4 boats weathered the hurricane. All others were capsized or beached.

No monetary estimate of damages is available.

Stonington, Connecticut. - Damages were estimated at about \$5,000,000 with the brunt of the losses occurring to the industrial plants and fishing fleet at Stonington Harbor and the cottage development at ^LFords Point.

Damages were reported as follows:

- a. Mason Island. One house destroyed, several others damaged.
- b. Mystic. Main Street under 4 feet of water. Cellars and stores flooded. Severe damage at the Mystic Marine Museum. Losses estimated to exceed \$50,000.
- c. Lords Point. 28 homes demolished and most of the remaining homes (originally 150) were damaged.
- d. Stonington Harbor. More than 20 fishing boats went aground or sunk. Sailboats by the score were overturned. Extensive damage

to boats and installations at the Stonington Boat Works and the Thomas boatyard. Both Bindloss docks and Lounge's dock were badly damaged. The York Marine Radio Shop was destroyed.

e. Stonington Village. The business section was flooded with industrial plants very hard hit. One plant, the Flax Corporation, reportedly sustained \$1,000,000 in damages. Business establishments along the waterfront were badly damaged as were homes on Water Street.

f. Wadawamuck Yacht Club. Bathhouses were carried away and the building damaged and twisted on its foundation.

g. Stonington Point. Material was eroded from behind the sea wall.

Rhode Island. - Damages from flooding and wave attack occurred throughout the coastal area of Rhode Island. Water damages were extremely costly because of tidal flooding of the business section of Providence. Beach developments along the state's south shore were almost completely wiped out. Hundreds of summer homes were destroyed or swept off the low sandy barrier beaches west of Point Judith. Cliffs and dunes out of reach of ordinary wave action were eroded. Damages to boats, piers, wharves and shorefront buildings were widespread. Damages to sea walls, groins and other shore protective structures were comparatively moderate, many such structures being overtopped by the extreme high tide with consequent destruction of property which they were intended to protect. An early estimate of property damage was as follows: 620 single homes destroyed, 888 single homes received major damage, 4060 single homes received minor damage, 58 farm buildings destroyed and another 525 received minor or major damage, other buildings (multiple dwellings, hotels, stores, factories, garages) 83 destroyed and 846 damaged, over 2000 boats wrecked or damaged. Insurance payments were estimated to range from \$100,000,000 to \$120,000,000 with over 50,000 claims. Estimated municipal public property damage was set at \$9,000,000 and state property damage at \$3,000,000. The governor estimated total state losses at about \$200,000,000.

Westerly, Rhode Island. - Damages in Westerly from flooding and overtopping of the barrier beaches by the high tide and from wave attack were extremely heavy, estimated losses exceeding \$2,000,000 of which approximately \$220,000 was attributed to municipal property. Reported damages were as follows:

- a. Napatux Beach. - The Watch Hill Beach Club and cabanas, the bath-houses of the Watch Hill Beach Association and the Day and Moore's houses were swept away. Beach sand was driven landward across the beach towards Watch Hill Cove.
- b. Watch Hill and Little Narragansett Bay. - Many sailboats and yachts were destroyed, sunk, or cast up on land. Flooding and destruction of property occurred along the Bayfront business center.
- c. Westerly Yacht Club. - Boat damage estimated at \$200,000.
- d. Misquamicut Beach. - Between Andrea Hotel and Atlantic Beach Casino, a distance of nearly 2 miles only 4 of more than 200 cottages remained upright. Scores of homes were picked off their foundations and deposited elsewhere, some moving hundreds of feet inland. Hotels, business blocks and rooming houses were badly damaged, some beyond repair. The Atlantic Beach Casino and its amusement

area were badly damaged. The shore road, Atlantic Avenue was buried under several feet of sand.

Weekapaug. - The yacht club and bathhouse washed into Mud Cove. More than 40 trailer homes were washed away as were many new homes along the beach drive. About 40 boats were piled on land. Buildings were wrecked on the west side of the inlet. Sand covered the shore road to the west along Atlantic Beach and to the east along Quamochohtaug Beach.

Charlestown, Rhode Island. - Damages from wave attack and flooding occurred along the low beach areas of Charlestown. Homes were destroyed or damaged, the barrier beach fronting Quamochohtaug Pond was breached in several places, and shoaling occurred at the old Quamochohtaug Inlet. Large quantities of sand were washed landward covering the shore roads. It was estimated that 150 dwellings and buildings were totally or partially damaged at Shady Harbor, East, West and Central Beaches in Quamochohtaug, Tegwotten, Sea Lea colony and Charlestown Beach. Estimated value of private property destroyed was about \$350,000 to \$400,000 and emergency public expenditures were approximately \$13,000. Reported damages were as follows:

- a. Quonochontaug Beach. - Two new channels about 30 feet wide opened across the beach into Quonochontaug Pond in addition to a number of smaller breaches which did not stay open.
- b. Quonochontaug Inlet. - The inlet shoaled so that it was reportedly 10 feet wide at mean low water.
- c. Quonochontaug and East Beach. - Only 2 of 22 homes were left between the "Blue Shutters" and the Charlestown town beach. The town beach and parking lot were wiped out.
- d. Sea Lea Colony. One-half of 28 sturdy homes located on the north shore of Green Hill Pond 1/4 mile from the ocean were carried off their foundations.

South Kingstown, Rhode Island. - Damages from flooding and wave attack occurred along the low beach areas of South Kingstown. Estimated losses amounted to \$2,650,000 with 378 homes destroyed, 1050 damaged, 117 boats wrecked and 354 damaged. Damages occurred along the Browning Beach, Matumuck and Succotash Point areas. The Jerusalem area was isolated by washout of the bridge on Succotash Road. Large quantities of sand were carried inland covering roads.

Narragansett, Rhode Island. - Estimated damages amounted to \$5,215,000 of which over \$900,000 was for emergency public expenses of damages to public

property. It was reported that 211 homes were destroyed, 511 damaged, 95 boats wrecked and 121 damaged. Damages were reported as follows:

- a. Jerusalem. - Cottages were destroyed or damaged.
- b. Galilee. - At least 50% of the U. S. Atlantic Tuna Tournament fleet sunk or damaged (20 ^S sunk, 15 damaged.)
- c. Point Judith. - Houses and cottages were tossed together.
- d. Scarborough Beach. - Damages to the parking area consisted of washouts of fill from behind the bulkhead and destruction of the chain link fence. Buildings north of the public beach were damaged or destroyed.
- e. Narragansett Pier. - Waves pounded Ocean Road tearing out the sea wall in two places, wrecking beach establishments, stores and taverns. The town pavilion bath houses and boardwalk were demolished. The Cananochet Club building buckled. The road was impassable from the Dunes Club southward through the business sections.
- f. Wesquage Beach. - Beach buildings were damaged.

North Kingstown, Rhode Island. - Estimated damages amounted to about \$4,000,000, of which \$2,000,000 was attributed to Federal property at Quonset Point and Davisville, \$1,000,000 to flooded homes and the business district in Wickford. The estimated loss to town public property was about \$50,000. Reported

damages were as follows:

- a. Packard's Rocks. - Cottages destroyed and damaged.
- b. Plum Beach. - Clubhouse destroyed.
- c. Wild Goose Point. - Bank and road out back, sea walls destroyed and cottages damaged.
- d. Cold Spring Beach. - Cottages wrecked or damaged. Walks and fence at public beach damaged.
- e. Poplar Point. - Cottages destroyed or damaged.
- f. Sauga Point. - Protective structures damaged or destroyed, banks out back, cottages undermined and damaged.
- g. North of Tibbets Creek. - Cottages damaged and areas behind low sea walls eroded.
- h. Wickford. - Business district and scores of homes flooded. Boatyards and marinas in shambles.

East Greenwich, Rhode Island. - Damages were estimated at \$300,000.

Reported damages were as follows:

- a. Potowomut. - Cottages destroyed or damaged. Shore eroded and street ends washed out south of Sandy Point.

b. Chepianoxet. - Railroad embankment eroded. Cottages and commercial buildings damaged. Bank eroded north of Chepianoxet Island. Old airplane plant probably a total loss.

c. Greenwich Bay. - East Greenwich Yacht Club, Greenwich Bay Shipyard and Arnold Boat Shop damaged.

Warwick, Rhode Island. - Estimated damages amounted to \$3,500,000 to \$4,000,000 with 250 buildings and 500 boats destroyed or damaged. Low beach developments at Oakland Beach and Conimicut Point were particularly hard hit. Estimated municipal property losses were \$150,000. Reported damages were as follows:

a. Arnold's Neck. - At least 5 homes destroyed.

b. Nausauket. - Cottages were destroyed or damaged and banks were eroded.

c. Buttonwoods. - Bank eroded, dwellings undermined, cottages destroyed or damaged. Road surface and timber groins damaged.

d. Oakland Beach. - Battered from the mouth of Brush Neck Cove, including Duck Cove along Seaview Drive to the east tip of Mohawk Avenue. Eighty homes were completely ruined and scores

of others were extensively damaged.

- e. Warwick Neck. - Cliff at Warwick Point cut back 30 to 40 feet.

Rocky Point Shore Dinner Hall destroyed and Rocky Point Bath

House gutted. At Highland Beach cottages were badly damaged

and fill eroded from behind sea walls.

- f. Conimicut. - Sixty-one homes gone and dozens of others damaged

beyond repair at Conimicut Point and Conimicut. Foundations

swept clean of buildings and sea walls and lawns washed out.

- g. Pawtuxet Shore. - Cottages were wrecked.

Cranston, Rhode Island. - Damages were estimated at \$1,000,000, largely

to boats and yacht clubs. The Rhode Island Yacht Club was washed away and the

Edgewood Yacht Club was badly damaged. Boat fleets at both clubs and at Port

Edgewood were sunk or beached. Half of the Pawtuxet Cove boat fleet was de-

stroyed or blown ashore. Four homes were destroyed or badly damaged.

Providence, Rhode Island. - Providence suffered the greatest monetary loss

of any place in New England with damages of at least \$32,000,000 and maybe

\$60,000,000. No firm estimates are available. City of Providence repairs for

city property and removal of trees and debris were estimated as over \$1,000,000.

The greater part of the losses in Providence resulted from flooding of the

business section of the city with consequent water damage to business establishments and personal property such as automobiles. Costly damages also occurred to vessels, waterfront buildings and harbor facilities.

East Providence. - News accounts reported damages vaguely as "several millions". Municipal property damages were estimated as \$359,400. Thirty homes were destroyed or heavily damaged, 2 boatyards and 1 boat club demolished, 2 oil refineries were heavily damaged, and there was "thousands of dollars" in boat wreckage or damage. High bluffs along Riverside and southward towards Bullock Point were eroded leaving many homes projecting over or dangerously close to the precipitous edge.

Barrington, Rhode Island. - Damages were estimated at about \$2,000,000 with 15 homes washed away, 30 made uninhabitable, 450 flooded and 100 severely damaged. Five hundred boats were damaged or wrecked and a boat club and yacht club were damaged. The heaviest damages occurred in the harbor, Adams Point, Nayatt Point and Rumstick Point areas as follows:

a. Harbor. - At least 50 boats beached or wrecked as well as 50 skiffs.

Some 75 homes in Tyler Point area flooded or battered. Estimated damage \$350,000

b. Adams Point. - Twenty homes partially wrecked, 30 flooded, 6 made uninhabitable. Damage \$400,000.

c. Rumstick Point to Nayatt Point. - Twenty homes stripped of furnishings, 40 flooded, 6 uninhabitable and at least 50 damaged in Nayatt area. Small boats lost totalled 50 to 60. Damage \$700,000.

d. Annawamscutt Beach. - Two homes carried away, 20 seriously damaged and 30 boats damaged or lost.

e. Bay Spring. - Twelve homes carried away, 25 uninhabitable, more than 200 flooded. At least 100 boats damaged or lost.

Damages for Annawamscutt Beach and Bay Spring \$350,000.

f. Hampden Meadows. - Homes flooded 75, seriously damaged 25.

More than 200 boats damaged, beached or wrecked. Damage

\$200,000.

In addition general cleanup operations for public highways and buildings were estimated at \$50,000.

Bristol, Rhode Island. - Estimated damages amounted to \$2,500,000. More than 15 homes were destroyed or badly damaged. A number of business establishments and other buildings were destroyed. Considerable water damage occurred from flooding. Damages to public property was estimated at \$110,000.

Warren, Rhode Island. - Estimated damages amounted to \$1,000,000.

At least 50 homes were washed away or wrecked and 50 made uninhabitable while 400 boats were lost or wrecked. ^{Tousset} Jausset bluffs were badly eroded.

Portsmouth, Rhode Island. - No estimate of the total damages is available. Reported losses consisted of destruction of 50 homes and damage to 100 others. Beach buildings at Sandy Point Beach were smashed. On Prudence Island, two stores, two docks, one cottage and practically all boats moored offshore were lost. The heaviest damage occurred at Island Park where at least 50 homes were swept from their foundations and many others were heavily damaged.

Middletown, Rhode Island. - No estimate is available of total hurricane losses. Damages to public property were estimated at \$150,000. Reported damages were as follows:

a. Second Beach. - Two buildings used for dressing at this public beach were destroyed.

b. Third Beach. - The beach club was wrecked. Bathhouses nearby were extensively damaged and cottages were swept away.

Newport, Rhode Island. - Estimated losses exceeded \$1,000,000. Damages to municipal property alone was approximately \$830,000. Public and private

bathing beach establishments along Newport's south shore were particularly hard hit. Reported damages were as follows:

- b. Hazard's Beach. - Completely wrecked and the remains scattered.
- c. Gooseberry Beach. - This newly built establishment was completely demolished.
- d. Bailey's Beach. - Eighty-one private cabanas, most expensively furnished, were hollow shells. Restoration involves rebuilding cabanas and bathhouses and making extensive repairs to the main buildings.
- e. Easton's Beach. - All but the main administration building and some sections of the bathhouse were carried away.
- f. Cliff Walk. - Erosion ripped away huge sections of the walk generally where the cliff was not protected.
- g. Ocean Drive. - The drive and some bordering houses were damaged.

Jamestown, Rhode Island. - Losses were estimated at \$2,000,000 for private property and \$500,000 for public property. Heavy damage occurred along the east shore road with houses picked up and deposited across the highway. Homes were completely destroyed or damaged. The east shore ferry station was badly damaged. Small craft and many larger schooners and cruisers were lost. Thirty-one yachts

were smashed into a pile at the Jamestown Yacht Club. Stores on Ferry Wharf were flooded. The Mackerel Cove causeway was covered with sand and many parts washed out.

Tiverton, Rhode Island. - Losses were estimated at \$1,500,000 consisting of destruction of more than 50 homes, 300 more badly damaged, 18 waterfront stores and other buildings severely damaged, 12 boats destroyed, the Nanaquaket Bridge destroyed and Stone Bridge heavily damaged. Summer cottages were heavily damaged at Fogland and Nanaquaket Pond and business establishments on Riverside Avenue received extensive damage.

Little Compton, Rhode Island. - Total damages were estimated at \$750,000. Four homes were washed away or destroyed, 50 homes were heavily damaged, 6 stores and other commercial buildings were destroyed or damaged, 106 boats were sunk or missing and the yacht club and several piers were destroyed. Estimated public property damage was \$40,000, of which \$30,000 was for restoration of town beach facilities. Trap fishermen and boat owners reportedly lost about \$300,000 in boats and gear. A channel 12 feet wide, 8 feet deep was cut across the road leading to Sakonnet Point.

Block Island, Rhode Island. - No estimate of damages is available. The island escaped with comparatively light losses. One home was badly damaged, 20 boats sunk or washed ashore, the roof ripped off Ocean View

Hotel and the dance hall at Ballards Inn was washed away and the dining facilities damaged.

Massachusetts. - Damages from flooding and wave attack occurred throughout the coastal area of Massachusetts. Heavy damages to beaches and shore developments were limited largely to (1) Buzzards Bay, particularly the north shore from Westport to Wareham, (2) the south shore of Cape Cod facing Vineyard Sound from Falmouth to Hyannis and (3) Marthas Vineyard. Erosion of beaches and destruction or damages to shore protective structures were comparatively moderate. Wave attack occurred generally at a higher level than the berms of beaches eroding bluffs and cliffs and sand dunes. Destruction and damages to all types of vessels were heavy and widespread, occurring at practically all harbor areas. An early estimate of building losses was as follows: single homes - 782 destroyed, 858 received major damage, 2613 received minor damage; other buildings (multiple dwellings, hotels, stores, factories, garages), 201 destroyed, 188 received major damage, 315 received minor damage. Damages to state forests and parks were estimated at \$2,000,000. Cost of clearing state highways was estimated at \$1,600,000 and damages to state owned property was estimated as \$4,200,000. Insurance claims were estimated as \$100,000,000 not including streets, public buildings, cars and boats. Total hurricane losses for Massachusetts were estimated up to about \$300,000,000.

Somerset, Massachusetts. - No monetary estimate of losses available.

Damages were reported as follows:

- a. Brayton Point. - A store, 3 houses and 2 Quonset huts swallowed up.
- b. Choinard Boat Yard. - Flattened. Small craft, skiffs and motorboats thrown up on the shore.
- c. Slades Ferry Bridge. - Damaged by floating logs.
- d. Brightman Street Bridge to Dighton. - Many homes damaged extensively or carried away.
- e. Somerset Yacht Club. - Carried away.

Swansea, Massachusetts. - No monetary estimate of losses available.

Damages were reported as follows:

- a. Touisset. - At least 50 cottages and homes and as many boats destroyed or severely damaged.
- b. Ocean Grove. - About 40 cottages in the Sandy Beach Area and 16 in the Bluffs section were washed away and demolished or suffered heavy damage. Sandy Beach restaurant a complete wreck.
- c. Lees River Bridge. - Damaged.

Fall River, Massachusetts. - No monetary estimate of total losses available.

Damages were reported as follows:

a. Gulf Oil Corporation. - More than \$1,000,000 damage to Bay

Street plant. An 1100-foot wharf washed away, pipe lines

ruptured and oil spilled, a tank under construction collapsed,

a huge sea wall smashed, dikes burst and electrical, fire and

pumping equipment damaged.

b. Firestone Company. - Flood damage causing plant shutdown.

Westport, Massachusetts. - Losses were estimated as \$800,000 to \$1,000,000.

Reported damages were as follows:

a. Westport Point. - Several buildings were wrecked. Fishing

boats were piled up on the pier at Westport Point.

b. Westport Harbor. - A sizeable section of the summer colony

homes were carried inland.

c. Herseneck Beach. - Many cottages were destroyed or damaged.

Only a few cottages escaped damage. Concession stands were

levelled. The road along the beach was covered with sand and

debris. Dunes were eroded and large quantities of sand moved

landward.

d. Gooseberry Neck. - The causeway approaches were washed out and

parts of the pavement undermined.

- e. East Horseneck Beach. - The beach was swept clean, cottages being destroyed or carried into the marsh to the north.

Dartmouth, Massachusetts. - No monetary estimate of losses available.

Damages were as follows:

- a. Little Beach. - Swept clean.
- b. Little River. - Highway bridge approaches washed out. Houses were demolished at the east side of Little River Inlet.
- c. Salters Point. - Residential ^{ce at} tip damaged. Lawns eroded behind riprap revetment east of the tip of the Point.
- d. Shore Acres. - Road to Round Hill washed out. Minor damage to homes.
- e. Apponagansett River. - Numerous boats were washed ashore above the highway bridge. Others were piled against the bridge. Sheds in the vicinity of the east end of the bridge were demolished.

New Bedford, Massachusetts. - Total losses were estimated as exceeding \$10,000,000 and as high as \$50,000,000. Heaviest losses resulted from flooding of industrial plants and damages to the fishing fleet. Damages were as follows:

- a. Clark Cove. - Paving behind riprap mound at north end of cove washed out. Concrete walk undermined and minor damage to the sea wall and revetment along the east shore.
- b. Acushnet Park. - Dan's pavilion demolished and sea wall damaged. Bathhouses uprooted and scattered.

c. Rodney French Boulevard. - Property received an unmerciful pounding with buildings and piers damaged or destroyed and industrial plants flooded.

d. Cove Road. - Twenty homes washed from foundations.

e. New Bedford Harbor. - Numerous industrial plants were flooded causing millions of dollars in damages. Steamship

Authority Pier loss estimated at \$500,000. Boatyard and

Fairhaven
~~Pishermen~~ waterfront damages estimated at \$3,000,000. De-

struction of trawlers and sea scallopers dealt the most

serious blow to the state's fishing industry. Sixty six

boats were sunk, damaged or driven ashore. Many boats were

smashed against the New Bedford - Fairhaven Bridge or left

high and dry on Pope's Island, Marine Park and Crow Island.

Thirty-four were sunk, 30 badly damaged and 2 missing.

Fairhaven, Massachusetts. - Losses were estimated at \$4,000,000 of which \$3,000,000 was to industrial and commercial real estate and vessels. At least 130 summer cottages and 35 year found homes were wrecked beyond repair and 200 more damaged with the hardest hit areas at Sconticut Neck and West Island.

Reported damages were as follows:

a. Fort Phoenix. - Bathhouse badly damaged.

b. Popes Beach. - Cottages and other buildings destroyed or damaged.

- c. Sconticut Neck and West Island. - Numerous summer cottages were swept away and destroyed. The West Island causeway was washed out.
- d. Wilbur's Point. - Severely hit - most homes destroyed.
- e. Silver Shell Beach. - Cottage colony gone.

Mattapoisett, Massachusetts. - Losses were estimated at \$1,500,000. Destruction of summer homes was exceptionally heavy with close to 300 demolished and another 300 badly damaged. All eight beach colonies were hard hit. Reported damages were as follows:

a. Mattapoisett Harbor. - The fleet of 100 pleasure boats was sunk or scattered about the golf course and along the shore and shore highway. The State Pier was almost destroyed with a loss close to \$200,000.

b. Crescent Beach. - The beach area on the seaward side of the road was almost swept clean of its numerous cottages. Many cottages were piled together or completely wrecked and the remains deposited along both sides of the road.

c. Connett Point. - The low bar extending toward Strawberry Point was swept clean. Many cottages at Connett Point were badly damaged.

Marion, Massachusetts. - No monetary estimate of damages available.

Reported or observed damages were as follows:

- a. Charles Neck. - A small cottage colony on the east shore was practically wiped out with cottages swept landward from their foundations into the woods.
- b. Sippican Harbor. - Sailing craft, power cruisers and small boats littered Front Street. Hardly a home, along the north end of the west side of the harbor escaped damage when yachts were washed across the road into buildings. Building at yacht storage area badly damaged.
- c. Pine Point. - Considerable damage.

Wareham, Massachusetts. - Losses were estimated at \$7,700,000 of which \$5,000,000 was for houses and cottages, \$2,000,000 for personal property, \$500,000 for business property and \$200,000 for town roads and beaches. A preliminary estimate listed 930 cottages wrecked, of which 363 were destroyed. The greatest destruction occurred at the Swift's Beach, - Swift's Neck area.

Reported or observed damages were as follows:

- a. Swift's Beach - Swift's Neck. - Cottages within 200 feet of the shore of Swift's Beach and 500 feet of the shore of Swift's Neck were destroyed. Cottages and furnishings were swept landward covering a very large area with debris and wreckage.

- b. Wareham Village and Wareham River. - Four feet of water over Main Street. Water damage to merchandise. Railroad tracks ripped up and railroad bridge over Wareham River washed out. Boats high and dry along Wareham River.
- c. Hamilton, Pinehurst and Parkwood Areas. - Summer cottages in bad shape.
- d. Onset Area. - Homes of many cranberry pickers destroyed.
- e. Onset Bay. - Numerous boats ashore. Buildings along the shore west of the wharf destroyed or damaged. Bluffs at Onset and Point Independence eroded.

Bourne, Massachusetts. - Losses were estimated at \$2,500,000. Damages to town roads were estimated at \$75,000 and to Otis Air Force Base at \$90,000. Reported damages were as follows:

- a. Bourne Neck. - Heavy summer cottage damage near the Maritime Academy. Houses skewed around, demolished or moved from foundations.
- b. Mashnee Island. - Island isolated by washout of dike.
- c. Back River. - Railroad washed out.
- d. Monument Beach. - Collapsed boatyard building moved and scattered as debris as were several smaller buildings.
- e. Pocasset. - Sloop beached and house moved from foundation.
- f. Patuisset. - Homes moved from foundations.
- g. Cataumet. - Estimated boatyard damage \$300,000, of which \$250,000 was to Federal property consisting of building materials used for boat construction.

Falmouth, Massachusetts. - Losses were estimated at \$2,000,000 with the principal damages located from Woods Hole eastward along the Vineyard Haven shore. Reported damages were as follows:

- a. New Silver Beach. - Houses, boats and debris carried inland.
- b. Woods Hole. - Banks eroded, boats driven ashore, piers wrecked and buildings and road damaged all along the Long Neck section of Great Harbor. Fish and Wildlife pier damaged. Railroad tracks damaged in the vicinity of Little Harbor. The Woods Hole Yacht Club moved and the fronting beach littered with debris and smashed boats. Homes along Gardner Road and Penance Point damaged. State Pier badly damaged.
- c. Noliska Point to Falmouth Harbor. - Erosion cut back the banks and undermined the railroad tracks. Cottages were destroyed or damaged sea walls damaged and the shore road partly washed out in the vicinity of Salt Pond.
- d. Falmouth Inner Harbor. - Buildings, pier and bulkhead destroyed.
- e. Falmouth Heights - Mara Vista. Cottages, sea walls and bulkheads destroyed or damaged and backfill eroded. Bridge approaches washed out. Roads damaged.
- f. East of Mara Vista. - Shore roads covered with sand or destroyed. Bridge approach washed out. Banks eroded behind riprap protection and bulkheads. Cottages destroyed or undermined.

Mashpee, Massachusetts. - No estimate of losses is available. Reported damages were as follows:

- a. South Cape Beach - Great Neck. Road washed out.
- b. Popponesset Beach. - Banks eroded, cottages destroyed or damaged.

Barnstable, Massachusetts. - No estimate of losses available. The towns suffered comparatively moderate damages. Some shore roads were washed out and shore homes were damaged and flooded. At Hyannisport a number of boats were destroyed beyond recognition. At Hyannis, small craft of the Hyannis Yacht Club were beached or smashed.

Yarmouth, Massachusetts. - Losses were estimated at \$50,000. Many houses were flooded or left with erosion problems. About 100 feet of South Shore Drive was washed out. Boats were scattered everywhere with about 50 smaller craft sunk in Bass River. A number of piers were carried away in Bass River.

Dennis, Massachusetts. - No estimate of losses available. Over 2000 persons were evacuated from beach areas. Shore front cottages were inundated or swept from their foundations. Few dwellings escaped damage. Trailers and tents took a terrific beating. Waterfront cottages were inundated at Old Wharf Village and West Dennis Beach.

Harwich, Massachusetts. - Waterfront losses were estimated as \$75,000 to \$100,000. Damages to boats and marine equipment were heaviest at Wychmere and Allans Harbor. The beach pavilion was smashed and the boardwalk destroyed at the Belmont Hotel at West Harwich. A dredge and barge were washed ashore at Wychmere Harbor.

Chatham, Massachusetts. - No estimate of losses available. Boat damage occurred in Stage Harbor and Nantucket Sound where many small boats were washed ashore, lost or sunk. Flooding of low areas occurred. In general losses were comparatively moderate.

Orleans, Brewster and Eastham, Massachusetts. - No estimate of losses available. Damages were largely due to wind and were comparatively moderate.

Provincetown, Massachusetts. - Losses were estimated at \$150,000 distributed evenly between real estate, public utilities and boats. Commercial and pleasure vessels were battered. Craft were beached or sunk. Trap fishermen suffered heavily.

Marthas Vineyard, Massachusetts. Losses were estimated at \$3,000,000 in the six towns of Marthas Vineyard. Land erosion, destruction of highways and water damage was extensive. Dwellings, principally in beach areas were partially or completely damaged and many pleasure and commercial craft were damaged or destroyed. Damages were reported as follows:

- a. Menemsha. - Fifteen boats damaged or destroyed. Several buildings had pilings undermined and were toppled.
- b. West Tisbury. - Minor building damage.
- c. Hariphs Creek. - Bridge approaches washed out.
- d. East Chop and between Oak Bluffs and Edgartown. - Beach road areas hit hard by water damage and land erosion. Fronts of buildings were smashed, beach and landfill eroded and gaps broken in sea walls.
- e. Edgartown. - Street areas along the harbor were flooded. The Edgartown Yacht Club was badly battered. Boats were sunk, thrown ashore or left suspended on wharves.
- f. Vineyard Haven. - Approximately 25 boats beached or sunk, most near the town pier though other craft, mostly pleasure boats were scattered on down the West Chop shore. The Oak Bluffs dock was damaged.

Nantucket, Massachusetts. - No estimate of losses available. The island escaped the brunt of the hurricane. It was reported that 15 to 20 boats were lost.

East Shore of Massachusetts. - Waterfront losses along the east shore of Massachusetts, north of Cape Cod, resulted principally from destruction, damage, beaching or sinking of hundreds of vessels ranging from skiffs and small sailboats to expensive cabin cruisers and yachts. Erosion of beaches and damages to shore protective structures ^{were} ~~was~~ comparatively moderate. Heavy damages reported in most urban areas were due to the action of winds knocking over trees, disrupting public utilities and damaging buildings. No overall estimate of waterfront damages is available. Brief descriptions of such damages at various locations are included below:

- a. Scituate. - A large number of yachts, cabin cruisers and smaller boats were washed ashore and badly damaged in Scituate Harbor.
- b. Hull. - Estimated losses \$500,000 from damages to boats and residences in Hull and Nantasket.
- c. Boston. - Numerous battered and wrecked craft were beached or piled against sea walls in the vicinity of the Savin Hill Yacht Club at Carson Beach, and at City Point near the South Boston Yacht Club. A U. S. Navy baby flat top broke its moorings and keeled over at East Boston.
- d. Winthrop. - Extensive damage reported at Winthrop, Pleasant Park and Cottage Park Yacht Clubs. Relatively little damage along shore areas. The newly placed fill at Winthrop Beach reportedly benefitted.
- e. Revere. - Losses estimated at \$1,000,000. Losses were largely due to flooding and damages to the amusement area caused by wind. The newly placed fill at Revere Beach placed behind sand dikes was washed down.

- f. Saugus. - Losses estimated at \$100,000. Six boats were lost in the Saugus River.
- g. Lynn. - Heavy losses were reported. Shore damages appeared minor so it is presumed that reported losses occurred inland from wind.
- h. Nahant. - Losses estimated at \$500,000 to \$1,000,000. More than 120 boats smashed. A new school gymnasium collapsed at Fort Ruckman.
- i. Swampscott. - Estimated that 25 boats were blown from moorings and smashed. Boats became kindling at the Kings Beach sea wall.
- j. Salem. - Heavy sea wall swept away at Hardy Point.
- k. Beverly. - Boat losses at Jubilee Yacht Club estimated at \$225,000. Of 80 to 90 boats only 15 held their moorings. Lobstermen reported extensive damage to boats.
- l. Manchester. - More than 30 boats were wrecked with the greatest damage to 4 yachts valued at \$100,000. Scores of small craft overturned. Others were beached or crushed against sea walls. Nearly 100 boats damaged, many beyond repair.
- m. Marblehead. - Losses, principally boat damage, were estimated at \$3,000,000. An estimated 200 craft, many expensive, on rocks, overturned or sunk.
- n. Rockport. - Losses to houses, boats and estates estimated at \$50,000. Five lobster boats were sunk at Pigeon Cove. Two sailboats wrecked in inner harbor. Twenty sailboats capsized. An estimated \$25,000 loss of lobster traps in Rockport and Gloucester.

- o. Gloucester. - Several boats lost at Eastern Point Yacht Club. Several power cruisers swept from moorings, dozens of sailboats overturned and piers battered at Annisquam.
- p. Essex. - Of 50 power, sail and outboard craft at Conomo Point, only 7 remained afloat.
- q. Newbury. - A dance hall was destroyed. The artificially restored sand beach was reportedly improved.

New Hampshire. - The principal losses along the New Hampshire coastal area resulted from destruction of or damages to small craft and flooding of beach areas. No serious erosion of beaches or destruction of shore protective structures were reported. Wind damage was heavy, particularly to agriculture. Estimated state wide losses were as follows: farms and crops, \$2,000,000; homes and boats, \$2,000,000; power lines (Public Service Company) \$500,000, telephone lines (New England Telephone and Telegraph Co.) \$200,000, highway damages \$250,000. Specific ^{losses} towns were reported as follows:

- a. Seabrook. - Several garages and small buildings were levelled or damaged at Seabrook Beach.
- b. Hampton. - At Hampton Beach, cottages were inundated and storefronts, awnings and roofs along the beachfront were damaged. Surf tossed sand, rocks and debris on Ocean Boulevard. About 20 small craft were torn from moorings in Hampton Harbor and scattered about the marshes. An estimated 3000 to 5000 people were evacuated from the beach area.
- c. Rye. - Almost 40 fishing and pleasure boats were sunk, badly damaged or battered to pieces in Rye Harbor. Losses were variously estimated as \$150,000 and \$250,000.
- d. New Castle. - Two large cabin cruisers and several small craft were washed ashore and damaged. The long pier at Hotel Wentworth was washed away.
- e. Portsmouth. - Three craft at the Portsmouth Yacht Club were lost or beached.

Maine. - The principal losses along the Maine coastal area resulted from destruction and damages to fishing and pleasure craft and fishing gear and from flooding of low beach developments. Statewide damages were estimated as \$10,000,000 of which \$5,000,000 was to farm buildings and crops, \$1,500,000 was to fishing vessels and gear and over \$500,000 to pleasure craft. Pleasure craft damages were reported at Portland, Camden, Casco Bay and Lake Sebago. Flooding and sea wall washouts were reported at Wells Beach.

COASTAL DAMAGES - HURRICANE EDNA

New England - General. - Damages along the coast of New England during hurricane Edna were comparatively moderate. The heaviest losses occurred as a result of flooding brought on by exceptionally heavy rainfall. No estimate of total losses is available. Damages described by the press are contained in the following paragraphs:

Rhode Island, -

- a. Westerly. - Damage was relatively light. Breakers broke over previously levelled dunes at ^Wesquameicut cutting out several channels - the biggest breakthrough east of the town beach at Atlantic Beach. Other breaks were observed east of Winnapaug Pond. Most damage in the town was from rainfall (6.35 inches) overflowing culverts and flooding streets with several minor washouts. Shore areas were comparatively untouched. One boat broke loose and was damaged in Watch Hill Cove.
- b. Charlestown. - Little damage consisting of road washouts, breaks across flattened sand dunes, broken windows and fallen tree limbs.
- c. South Kingstown. - Seven or eight fishing boats were damaged at Galilee and East Matunuck. The rain flooded roads at Green Hill, Matunuck and East Matunuck but did not damage any property.
- d. Narragansett. - Power was out and Beach Street was flooded.
- e. Warwick and East Greenwich. - Some power lines out, roads flooded and telephone service hampered.

- f. Bristol, Barrington and Warren. - Streets were flooded by rain in Warren and Bristol. Tan Yard Brook overflowed. Power and telephones out. Shingles lost from many houses.
- g. Little Compton. - Thirteen (13) boats were destroyed or damaged in Sakonnet Harbor with an estimated \$150,000 loss.
- h. Middletown. - Flooding from rain worse than any prior storm.
- i. Newport. - Biggest damage to telephone and electric wires. Several luxury craft grounded at Ida Lewis Yacht Club. Some boats off Washington Street lost. Cellars flooded by rain water.
- j. Flooded Areas. - Blackstone River at Woonsocket, Harris Pond in Woonsocket, Ten Mile River in East Providence, South Branch of Pawtuxet River in Coventry, Pawcatuck River in Ashaway.

Massachusetts. -

- a. New Bedford. - Many waterfront industrial plants flooded.
- b. South Shore of Cape Cod. - Numerous buildings were partially damaged by high winds. Many small craft were driven ashore in harbors.
- c. Flood Area. - Sudbury River in Framingham Center.

New Hampshire. - Total damages were estimated as follows: State and town highways \$1,000,000, private property \$1,000,000, agriculture (apple crop) \$150,000, utilities \$350,000. A dam on the Exeter River broke flooding Exeter. At Hampton, sections of Ocean Boulevard in the Boars Head district were inundated.

Maine. - Damages estimated at \$7,000,000 occurred principally by flooding. Floods washed out railroad tracks, highways and crops. The Kennebec River rose to 20 feet above normal. Homes at Old Orchard were flooded. Torrential rains and high tides flooded York Beach.

Wave Action. - Information was obtained from the United States Coast

Guard concerning heights of waves and the state of the sea with correspon-

dence data on wind speeds and direction and time of passage of the hurri-

canes at installations in the First Coast Guard District. Data extracted

from this information covering the peak period of each hurricane are included

in the following tabulations.

WIND AND WAVE DATA DURING HURRICANE CAROL
August 31, 1954

at United States Coast Guard Installations

Location	U.S. Coast Guard Unit	Time (EDT)	Wind *		Sea **		Estimated Time Center Passed Closest to Unit	REMARKS
			Speed or Beaufort No.	Direction	Wave Height or Condition No.	Direction		
Block Island Rhode Island	Block Island LBS	1200 (a)	65 with Gust to 80	E	35-40	SE	1200	(a) Applies to wind data only
Narragansett Rhode Island	Point Judith LBS	1100	Hurricane Force (No. 12)	SE	40-45	SE	1400	
Newport Rhode Island	Castle Hill LBS	1200	Over 75	SE	4-8	-	1200	
Narragansett Bay Entrance, R.I.	Brenton Reef L. S.	1100 1200 1300-1500	Hurricane Force (No. 12) " "	NE SSW WSW	Sea No. 12(b) " " " "	- - -	- - -	(b) Highest known sea number is 9 which means confused sea.
Buzzards Bay Entrance, Mass.	Hans and Chickens L. S.	1200	Whole Gale to Hurricane Force (No. 11-12)	SW	Sea No. 8 (c)	-	-	(c) Precipitous sea, 40 feet and over
Marthas Vineyard Mass.	Gay Head LBS	1215	Over 75	ESE	20(d) 12-15(e)	NE SE	1215	(d) Back side of Marthas Vineyard (e) In Vineyard Sound
Vineyard Sound Entrance	Vineyard Sound L. S.	1200-1500	Hurricane Force (No. 12)	SW	55	-	-	
Atlantic Ocean	Nantucket Lightship	1600	63	SW	25			
Newburyport Mass.	Merrimac River LBS	1200 1400	100 60-70	NE SW	10 10	NE NE	1230	
Rockland, Me.	Rockland Mooring	1230	Hurricane Force (No. 12)	N	10	E	1230	

* Wind is listed speed in miles per hour or by Beaufort wind scale number, as reported. No. 11 = 64-72 MPH & No. 12 = 73-82 MPH

** Sea is listed by height of waves in feet or by number designating sea condition. Descriptions according to United States Navy Hydrographic Office Sea Scale have been added in the last column under remarks.

WIND AND WAVE DATA DURING HURRICANE EDNA
September 11, 1954

at United States Coast Guard Installations

Location	U. S. Coast Guard Unit	Time (EDT)	Wind *		Sea **		Estimated Time Center Passed Closest to Unit	REMARKS
			Speed (MPH)	Direction	Wave Height or Condition No.	Direction		
Block Island Rhode Island	Block Island LBS	1200 (a)	48 with Gust to 55	NNE	20-25	N	1200	(a) Applies to wind data only
		1500 (a)	50-60	NNW				
Narragansett, Rhode Island	Point Judith LBS	1500	Whole Gale Force (No. 11)	NW	35-40	NN	1400	
Newport, Rhode Island	Castle Hill LBS	1600	Above 75	NW	Over 8	-	1600	
Narragansett Bay En- trance, Rhode Island	Brenton Reef LS	1300	Whole Gale Force (No. 11)	NE	Sea No. 10(b)	-	-	(b) Highest known Sea Scale no. is 9 which means confused sea.
		1400	Hurricane Force (No. 12)	NE	" " "	-	-	
		1500	Hurricane Force (No. 12)	NNE	" " "	-	-	
Buzzards Bay Entrance Mass.	Hans and Chickens L.S.	1200	Whole Gale Force (No. 10)	E	Sea No. 6(c)	-	-	(c) High sea, 12 to 20 foot waves (d) Very rough sea, 8-12 foot waves
		1600	Hurricane Force (No. 12)	NW	Sea No. 5(d)	-	-	
Cuttyhunk, Mass.	Cuttyhunk LBS	1500	120	NW	20	NN	1445	
Marthas Vineyard Mass.	Gay Head LBS	1600	Over 75	NN	15(e) 9(f)	NN SE	1440	(e) Back side of Marthas Vineyard (f) Vineyard Sound
Woods Hole, Mass.	CG Base Woods Hole	1500	Hurricane Force (No. 12)	NE	6(g)	E	1500	(g) Vineyard Sound
Marthas Vineyard Mass.	Gay Head LBS	1600	Over 75	NN	15(e)	NN	1440	(e) Back side of Marthas Vineyard
					9(f)	SE		(f) Vineyard Sound
Woods Hole, Mass.	CG Base Woods Hole	1500	Hurricane Force (No. 12)	NE	6(g)	E	1500	(g) Vineyard Sound

WIND AND WAVE DATA DURING HURRICANE EDNA
September 11, 1954
at United States Coast Guard Installations

Location	U.S. Coast Guard Unit	Time (EDT)	Wind *		Sea **		Estimated Time Center Passed Closest to Unit	REMARKS
			Speed (MPH)	Direction	Wave Height or Condition No.	Direction		
Atlantic Ocean	Nantucket Lightship	1330 to 1530	86-92 (Gusts to 105)	SSE	30-40	-	-	Ship struck by immense wave at 1555, parting mooring chain & setting ship adrift
		1530 to 1550	74-86 (Gusts to 94)	S to SSW	Wave heights in- creased	-	-	
		1600 to 1730	69-80	S	30-40	-	-	
Eastham, Mass.	Nauset LES	1200	Whole Gale Force (No.11)	ESE	10	SSW	1430(h)	(h) Second eye passed around 1700 with gusts over 100 M.P.H.
		1600	Whole Gale Force (No.11)	SW	8	SSW		
Sandwich, Mass.	Cape Cod Canal LES	1350	60	ESE ENE	15	E	1500	
		1500	18	ESE	15	E		
		1600	50	NNW	10	NW		
		1650	90	WNW	12	W		
Duxbury, Mass.	Gurnet LES	1600	120	NW	10	NW	1330	
Scituate, Mass.	Scituate LES	1200	Hurricane Force (No.12)	ESE	10	ESE	1600	
		1600	Hurricane Force (No.12)	N	8	N		
Hull, Mass.	Point Allerton LES	1700	85-90	NW	15-20	NW	1700	
Gloucester, Mass.	Gloucester LES	1600	Hurricane Force (No.12)	ESE	18	ESE	1800	
Rockport, Mass.	Straitsmouth LES	2000	Whole Gale Force (No.10)	NW	15	NE		
Newburyport, Mass.	Merrimac River LES	1600	75-80	NW	Moderate Sea	NE	1600	
Hampton, New Hampshire	Hampton Beach LES	1700	Whole Gale Force (No.10)	NW	10	NE	1700	

WIND AND WAVE DATA DURING HURRICANE EDNA
September 11, 1954
at United States Coast Guard Installations

Location	U. S. Coast Guard Unit	Time (EDT)	Wind *		Sea **		Estimated Time : Center Passed : Closest to Unit:	REMARKS
			Speed (MPH)	Direction	Wave Height or Condition No.	Direction		
New Castle, N.H.	Portsmouth Hbr. LBS	1700	50	NN	6	NN	1700	
Biddeford Pool, Maine	Fletchers Neck LBS	1600 & 1635	70-75	N	9	SE	2000	(1) 12' waves reported from 1700 to 2400 with winds decreasing from 65 MNW to 35N
		1630	0	-	9	SE		
		2000	45	NNW	12 (1)	SE		
Cape Elizabeth, Maine	Cape Elizabeth LBS	2000	Strong (No. 6)(f)	NN	8	E	2000	Winds of 74 m.p.h. at 1740 reported at Portland
Boothbay Harbor, Maine	Damariscove Island LBS	2100	Whole Gale Force (No. 11)	NN	30	NE	2200	
Spruce Head, Maine	Whitehead LBS	2130	Hurricane Force (No. 12)	NE	20	NE	2100	
Port Clyde, Maine	Burnt Island LBS	1900	85-90	NNW	8-10	ENE	1900	
Rockland, Maine	Rockland Moorings	2150	Hurricane Force (No. 12)	N	10	E	2150	
West Jonesport, Maine	Moose Peak LBS	2200	Gale Force (No. 8)	SE	40	S	2200	
Machiasport, Maine	CRP SS Island LBS	2100	60 (Gusts to 80)	SSE	30	S	2200	
Lubec, Maine	Quoddy Head LBS	2000	Hurricane Force (No. 12)	NN	20-25	NN	2030	
		2400	Hurricane Force (No. 12)	NN	30-35	NN		

* Wind is listed by speed in miles per hour or by Beaufort wind scale number, as reported. In miles per hour No. 8 = 39-46; No. 9 = 47-54; No. 10 = 55-63; No. 11 = 64-72; No. 12 = 73-82.

** Sea is listed by height of waves in feet or by number designating sea condition. Descriptions according to United States Navy Hydrographic Office Sea Scale have been added in the column under "Remarks".

TABLE OF CONTENTS

<u>Paragraph No.</u>	<u>Subject</u>	<u>Page No.</u>
1.	Authority	1
2.	Scope	1
3.	Purpose	1
4.	The Hurricanes	2
5.	Coastal Flooding and Wave Producing Effect of the Hurricanes	3
	Tables	
	Wind and Wave Data During Hurricane Carol	4
	Wind and Wave Data During Hurricane Edna	5
6.	Weather Data	8
	Tables	
	Time of Peak Gusts	8
	Table 1 - Summary Tabulation of Wind, Barometric Pressure, and Precipitation	9
	Table 2 - Wind Data, New Haven, Connecticut	10
	Table 3 - Wind Data, Block Island, Rhode Island	11
	Table 4 - Wind Data, Hillsgrove, Rhode Island	12
	Table 5 - Wind Data, Nantucket Island, Massachusetts	14
	Table 6 - Wind Data, Logan International Airport, East Boston, Massachusetts	15
	Table 7 - Wind Data, Portland City Airport, Portland, Maine	19
7.	Tidal Heights	20
	Tables	
	Table 8 - Tidal Heights, Coast and Geodetic Survey Stations (General)	21
	Table 9 - Tidal Heights at Other Locations	22
8.	Storm Effects and Losses, General	24
	Tables	
	Table 10 - Damage to Government Structures and Installations	25
	Table 11 - Boat Losses	26
	Table 12 - Shore Damage	27
9.	Brief Description of Coastal Damage, Hurricane Carol	
	a. Connecticut	28
	b. Rhode Island	28
	c. Massachusetts	29
	d. New Hampshire	29
	e. Maine	29
10.	Coastal Damage, Hurricane Edna, New England, General	30
11.	Recapitulation of Damage Caused by Hurricanes Carol and Edna	30
12.	Photographs of Storm Damage	30

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
NEW ENGLAND DIVISION
BOSTON 15, MASSACHUSETTS

December 8, 1954

RESUME REPORT ON THE HURRICANES OF AUGUST 31 and SEPTEMBER 11, 1954

IN THE
COASTAL REGION OF NEW ENGLAND

AUTHORITY

1. This resume report of damage caused by hurricanes of August 31, 1954 (Carol) and September 11, 1954 (Edna) to the coastal region of New England has been prepared in accordance with paragraph 4216.20e, Part II, Chapter IV, of Orders and Regulations of the Corps of Engineers, dated 3 August 1953, pertaining to Civil Work Operations, Procedures during Emergencies.

SCOPE AND PURPOSE

2. Scope. - The area covered in this report is confined to the coastal region within the limits of the New England Division. No attempt has been made to estimate the inland damage which resulted from hurricane winds of the August storm or from floods caused by run-off from torrential rains of the September storm. Information contained herein has been compiled from press accounts, contacts with local officials, and from reports of U. S. Weather Bureau stations within the area, supplemented by a limited field investigation, by Division personnel, of the more seriously devastated localities.

3. Purpose. - The report presents a general description of the two storms, with pertinent meteorological data. The effects of the storms are considered, first, as affecting navigation and second, as affecting shore properties and installations. Under navigation, the report is concerned with damage to channels, protective structures, such as breakwaters, jetties, and revetments, and loss or damage to commercial and pleasure craft. Under shore properties and installations, the report is concerned with damage to beaches, industrial and residential properties, highways, and utilities.

THE HURRICANES

4. The storm of August 31 caused far greater destruction in the New England area than the storm of September 11, although the latter received greater publicity as it approached the New England Coast. The August hurricane, designated "Carol", moving in a north-northeasterly direction from Cape Hatteras, crossed over the easterly end of Long Island and entered into the New England area at the south shore of Rhode Island. The September hurricane, designated "Edna", moving in a north-northeasterly direction from offshore of Cape Hatteras, approached New England on a course somewhat easterly of the preceding storm and entered New England in the vicinity of Marthas Vineyard. The course of "Carol" extended across Rhode Island, eastern Massachusetts and along the Maine-New Hampshire border into Canada through the St. Lawrence Valley. The course of "Edna" extended across Cape Cod, the Gulf of Maine to the vicinity of Eastport, Maine and thence through New Brunswick, Canada. The northeasterly movement of "Carol" accelerated from 12 to 40 miles an hour as it approached New England, whereas the acceleration of "Edna" increased up to 35 miles an hour as it traversed the New England Coast. Hurricane "Carol" struck the Rhode Island area in full strength at approximately 10:30 A. M. (E.S.T.) with sustained winds up to 90 miles per hour and gusts up to 105 miles per hour. The eastern Massachusetts coastal area received the full impact of the storm at approximately 11:30 A. M. (E.S.T.) when winds at 86 miles per hour were recorded at weather bureau station at Logan Airport, with gusts up to 100 miles per hour. Heavy rains accompanied the storm, 2.60 inches being recorded at both Boston and Providence. With rapidly diminishing effect, the storm moved northward into Maine and New Hampshire. Hurricane "Edna" passed over southeastern New England in the early afternoon of September 11, 1954, the center moving over Marthas Vineyard. Winds of 73 miles per hour were recorded, with gusts up to 90 miles per hour. Boston and Portland, both lying westerly of the storm's center, were buffeted with winds up to 48 and 60 miles per hour respectively, and gusts up to 78 and 74 miles per hour. Precipitation over the entire coastal area was torrential, with Providence reporting 4.37 inches, Boston 5.64 inches and Portland 7.49 inches. Most of the damage resulting from the storm was due to flooded streams in the inland areas. The storm moved into New Brunswick, Canada, leaving relatively minor damage along the New England Coast.

COASTAL FLOODING AND WAVE PRODUCING EFFECT OF THE HURRICANES

5. The chance circumstance of the normal high water coinciding with the full easterly intensity of the hurricane's strength, as the storm of August 31 struck the southern New England Coast and Massachusetts Bay area, resulted in abnormally high tides and destructive wave action. In comparison, the September storm, with winds of somewhat lesser intensity offshore and with the time of high tide generally at considerable variance with the maximum velocity of the storm, produced relatively minor flooding and wave action. Wind and wave data for both storms, compiled from records of the Coast Guard installations, are given in the following tables:

WIND AND WAVE DATA DURING HURRICANE CAROL
August 31, 1954

At United States Coast Guard Installations

Location	U.S. Coast Guard Unit	Time (EDT)	Wind		Sea		Estimated Time Center Passed Closest to Unit
			Speed (MPH)	Direction	Wave Height in Feet	Direction	
Block Island Rhode Island	Block Island LBS	1200	65 with Gust to 80	E	35-40	SE	1200
Narragansett Rhode Island	Point Judith LBS	1100	Hurricane 73-82	SE	40-45	SE	1400 - ?
Newport Rhode Island	Castle Hill LBS	1200	Over 75	SE	4-8	-	1200
Narragansett Bay Entrance, R.I.	Brenton Reef L.S.	1100 1200 1300-1500	Hurricane 73-82	NE SE SW	Over 40 " "	- - -	- - -
Buzzards Bay Entrance, Mass.	Hens and Chickens L.S.	1200	Whole Gale to Hurricane Force 64-82	SW	Over 40	-	-
Marthas Vineyard Mass.	Gay Head LBS	1215	Over 75	ESE	20(a) 12-15(b)	NW SE	1215
Vineyard Sound Entrance	Vineyard Sound L.S.	1200-1500	Hurricane 73-82	SW	55	-	-
Atlantic Ocean	Nantucket Lightship	1600	63	SW	25		
Newburyport Mass.	Merrimac River LBS	1200 1400	100 60-70	NE SW	10 10	NE NE	1230
Rockland, Mo.	Rockland Moorings	1230	Hurricane 73-82	N	10	E	1230

(a) Back side of Marthas Vineyard

(b) In Vineyard Sound

WIND AND WAVE DATA DURING HURRICANE EDNA
September 11, 1954
at United States Coast Guard Installations

Location	U. S. Coast Guard Unit	Time (EDT)	Wind		Sea	Estimated Time Center Passed Closest to Unit
			Speed (MPH)	Direction	Wave Height in Feet	
Block Island Rhode Island	Block Island LBS	1200	45 with Gust to 55	NNE	20-25	1200
		1500	50-60	NNW		
			Whole Gale			
Narragansett, Rhode Island	Point Judith LBS	1500	55-75	NE	35-40	1400
Newport, Rhode Island	Castle Hill LBS	1600	Above 75	NW	Over 8	1500
Narragansett Bay En- trance, Rhode Island	Brenton Reef LS	1300	Whole Gale			
			55-75	SE	Over 40	-
		1400	Hurricane	NE	" " "	-
Buzzards Bay Entrance Mass.	Hens and Chickens L.S.	1500	75 plus	ENE	" " "	-
Cutttyhunk, Mass.	Hens and Chickens L.S.	1200	Whole Gale			
			55-75	E	12-20	-
		1600	Hurricane	NW		-
Marthas Vineyard Mass.	Cuttyhunk LBS		75 plus		8-12	
		1500	120	NW	20	1445
Woods Hole, Mass.	Gay Head LBS	1600	Over 75	NW	15(a) 9(b)	1440
Marthas Vineyard Mass.	OG Base Woods Hole	1500	Hurricane			
			75 plus	NE	6(b)	1500
		1600	Over 75	NW	15(a)	1440
Woods Hole, Mass.	OG Base Woods Hole				9(b)	
		1500	Hurricane			
			75 plus	NE	6(b)	1500

(a) Back side of Marthas Vineyard

(b) Vineyard Sound

WIND AND WAVE DATA DURING HURRICANE EDNA
September 11, 1954
at United States Coast Guard Installations

Location	U. S. Coast Guard Unit	Time (EDT)	Wind		Sea		Estimated Time Center Passed Closest to Unit
			Speed (MPH)	Direction	Wave Height in Feet	Direction	
Atlantic Ocean	Nantucket (1) Lightship	1330 to 1530	86-92 (Gusts to 105)	SSE	30-40	-	-
		1530 to 1550	74-86 (Gusts to 94)	S to SSW	-	-	-
		1600 to 1730	69-80	S	30-40	-	-
Eastham, Mass.	Nauset LBS	1200	Whole Gale 55-75	ENE	10	SSW	1430 (2)
		1600	Whole Gale 55-75	SE	8	SSW	
Sandwich, Mass.	Cape Cod Canal LBS	1350	60	ENE	15	E	1500
		1500	18	NNE	15	E	
		1600	50	NNW	10	NW	
		1650	90	NNW	12	W	
Duxbury, Mass.	Gurnet LBS	1600	120	W	10	NW	1330
Scituate, Mass.	Scituate LBS	1200	Hurricane 75 plus	SSE	10	SSE	1600
		1600	Hurricane 75 plus	N	8	N	
Hull, Mass.	Point Allerton LBS	1700	85-90	W	15-20	W	1700
Gloucester, Mass.	Gloucester LBS	1600	Hurricane 75 plus	ENE	18	SSE	1800
		2000	Whole Gale 55-75	W	15	NE	
Rockport, Mass.	Straitsmouth LBS	1600	75-80	W	6	NE	1600
Newburyport, Mass.	Merrimac Riv. LBS	1700	55-75	W	10	NE	1700
Hampton, New Hampshire	Hampton Beach LBS	1700	55-75	W	10	NE	1700

(1) Ship struck by immense wave at 1555, parting mooring chain and setting ship adrift.

(2) Second eye passed around 1700 with gusts over 100 M.P.H.

WIND AND WAVE DATA DURING HURRICANE EDNA
September 11, 1954
at United States Coast Guard Installations

Location	U. S. Coast Guard Unit	Time (EDT)	Wind		Sea		Estimated Time Center Passed Closest to Unit
			Speed (MPH)	Direction	Wave Height in Feet	Direction	
New Castle, N.H.	Portsmouth Hbr. LBS	1700	50	NW	6	NW	1700
Biddeford Pool, Maine	Fletcher's Neck LBS	1600 & 1635	70-75	N	9	SE	2000
		1630	0	-	9	SE	
		2000	45	NNW	12 (i)	SE	
Cape Elizabeth, Maine	Cape Elizabeth LBS	2000	25-38	NW	8	E	2000
Boothbay Harbor, Maine	Damariscove Is. LBS	2100	Whole Gale 55-75	NW	30	NE	2200
Spruce Head, Maine	Whithead LBS	2130	Hurricane .75 plus	NE	20	NE	2100
Port Clyde, Maine	Burnt Island LBS	1900	85-90	NNW	8-10	ENE	1900
Rockland, Maine	Rockland Moorings	2150	Hurricane .75 plus	N	10	E	2150
West Jonesport, Maine	Moose Peak LBS	2200	Gale 39-54	SE	40	S	2200
Machiasport, Maine	CRP SS Island LBS	2100	60 (Gusts to 80)	SSE	30	S	2200
Lubec, Maine	Queddy Head LBS	2000	Hurricane .75 plus	NW	20-25	NW	2030
		2400	Hurricane .75 plus	NW	30-35	NW	

Winds of 74 m.p.h. at 1740 reported at Portland.

6. Weather data. - A summary tabulation of wind, barometric pressure, and precipitation for the two storms, obtained from selected weather bureau stations in coastal New England, is given in Table 1. Hourly wind data for these stations are shown in Tables 2, 3, 4, 5, 6 and 7. Times of peak gusts are noted in the following table:

<u>STATION</u>	<u>TIME OF PEAK GUST (E.S.T.)</u>	<u>VELOCITY, M.P.H. AND DIRECTION</u>
<u>"Carol"</u>		
New Haven, Ct.	0930	65 N
Block Island, R.I.	1005	135 estimated SE
Providence, R.I.	1030	105 ESE
Nantucket, Mass.	1125	73 S
Boston, Mass.	1148	100 SE
Portland, Me.	1321	78 E
<u>"Edna"</u>		
New Haven, Ct.	1129	52 N
Block Island, R.I.	1430	110 estimated NW
Providence, R.I.	1444	79 N
Nantucket, Mass.	1305	90 SSE
Boston, Mass.	1321	78 E
Portland, Me.	1740	74 NW

TABLE 1

STATION	DATE	BAROMETRIC PRESSURE (Sea Level)	WIND DATA						24-HOUR PRECIPITATION
			One-minute wind speed (m.p.h.)	Direction	Time (E.S.T.)	Peak Gust (m.p.h.)	Direction	Time (E.S.T.)	Rain
New Haven, Ct.	31 Aug 54	28.77	38	NE	0930	65	N	0930	2.62 inches
Municipal Airport	11 Sep 54	29.08	33	NW	1029	52	N	1129	4.61
Block Island, R.I.	31 Aug 54	28.50	100 estimated	SE	1005	135 estimated	SE	1005	2.98
State Airport	11 Sep 54	28.59	87 "	NNW	1430	110	NNW	1430	3.91
Providence, R.I.	31 Aug 54	28.69	90	ESE	1030	105	ESE	1030	2.60
T.F. Green Airport	11 Sep 54	28.73	55	NW	1444	79	N	1444	4.37
Nantucket, Mass.	31 Aug 54	29.32	55	S	1125	73	S	1125	1.76
Memorial Airport	11 Sep 54	28.18	73	SE	1305	90	SSE	1305	1.64
Boston, Mass.	31 Aug 54	28.83	86	SE	1126	100	SE	1148	2.60
Logan Airport	11 Sep 54		48	E	1304	78	E	1321	5.64
Portland, Maine	31 Aug 54	29.14	69	E	1310	78	E	1321	2.26
City Airport	11 Sep 54	28.88	60	NW	1733	74	NW	1740	7.49

TABLE NO. 2

U. S. Weather Bureau Station

New Haven Airport - August 31, 1954

WIND DATA

<u>Time</u> <u>(E.S.T.)</u>	<u>Direction</u>	<u>One-Minute</u> <u>Wind Speed</u> <u>(m.p.h.)</u>	<u>Gusts</u> <u>(m.p.h.)</u>
0628	NE	24	36
0730	NNE	30	42
0830	NNE	40	54
0930	N	40	65
1030	NE	20	34
1130	E	25	38
1228	NNE	20	34
1330	E	17	-
1430	WSW	15	-
1530	WSW	13	-

Peak Gust - 65 m.p.h. at 0930 - North

New Haven Airport - September 11, 1954

0430	NNE	15	-
0530	NNE	16	-
0628	NNE	20	30
0730	NNE	18	30
0829	NNE	22	35
0930	N	24	39
1029	N	30	50
1129	N	26	52
1230	N	25	45
1330	NN	18	26
1431	NE	15	25
1530	NE	20	30

Peak Gust - 52 m.p.h. at 1129 - North

TABLE NO. 3

U. S. Weather Bureau Station

Block Island, R. I. - August 31, 1954

WIND DATA

<u>Time</u> (E.S.T.)	<u>Direction</u>	<u>One-Minute</u> <u>Wind Speed</u> (m.p.h.)	<u>Gusts</u> (m.p.h.)
0700	ENE	42	55
0800	E	52	75
0900	SE	65	85
1000	SE	85	120
1100	S	90	105
1200	SSW	65	80
1300	SW	45	60
1400	SW	35	45
1500	SW	37	45

Fastest mile - 100 m.p.h. at 1005 - SE
Peak Gust - 135 m.p.h. at 1005 - SE

Block Island, R. I. - September 11, 1954

0700	E	25	-
0800	ENE	35	40
0900	NE	50	60
1000	NE	50	58
1100	NE	54	65
1200	NNE	48	55
1300	NNW	70	94
1400	NNW	70	85
1500	NNW	55	60

Fastest mile - 87 m.p.h. at 1430 - NNW
Peak Gust - 110 m.p.h. at 1430 - NNW

TABLE 4

Weather Bureau Airport Station
T. F. Green Airport
Hillsgrove, R.I.
HURRICANE OF AUGUST 31, 1954
(TIME---EST)

On August 31, 1954, Hurricane "Carol" struck Rhode Island with its full force and fury causing extensive flooding in areas along the South Shore and Narragansett Bay and in downtown Providence, and leaving 19 dead with an estimated property damage of over \$200,000,000. The center or eye of the hurricane moved rapidly north-northeastward across the western part of the State, passing a short distance to the west of this station at 11:45 A.M. Lowest Sea Level Barometer reading recorded at this station was 28.69 inches at 10:45 A.M.

Flooding began in downtown Providence at about 10:00 A.M., reaching its peak about 12:00 Noon, which was approximately 17 feet above Mean Low Water, or just about 9 inches lower than the high level for the 1938 hurricane. The water began to recede about 12:30 P.M., and was down to the level of the River Banks by about 1:00 P.M., with the exception of some lower spots in the City which remained flooded until about 3:00 P.M.

Rain, associated with the hurricane, began at 8:52 P.M. on the 30th and ended at 11:30 A.M. on the 31st, with the total rainfall amounting to 2.79 inches. The period of heaviest rainfall was between 7:15 A.M. to 10:15 A.M., when it totaled 1.70 inches.

Maximum amounts of rainfall for short periods of time are listed below:

5 min. - .15	20 min. - .50	60 min. - .97	120 min. - 1.31
10 min. - .27	30 min. - .64	80 min. - 1.07	150 min. - 1.47
15 min. - .35	45 min. - .82	100 min. - 1.20	180 min. - 1.70

Winds increased to Gale Force (40 mph or over) by 8:30 A.M. and to Hurricane Force (75 mph or over) by 10:30 A.M., with sustained winds of Hurricane Force lasting for about an hour, and then subsiding gradually to below Gale Force by 2:15 P.M. As the storm center approached this area, the wind veered gradually from the Northeast around through the East and Southeast, and finally into the Southwest. The highest observed one-minute wind speed was 90 mph, with a Peak Gust of 105 mph from the ESE at 10:30 A.M.

Pertinent wind data are listed in the table below:

Time (E.S.T.)	Direction	One-Minute Wind Speed (m.p.h.)	Gusts (m.p.h.)
0828	NE	40	48
0902	ENE	50	72
0928	ENE	45	68
0935	ENE	55	75
0948	ENE	60	88
1009	ENE	65	85
1015	E	70	89
1020	E	73	95
1028	ESE	75	100
1030	ESE	90	105
1045	ESE	85	100
1059	SE	80	97
1128	SSE	60	80
1135	S	65	82
1150	SSW	60	75
1205	SSW	55	72
1228	SSW	40	60
1306	SW	40	58
1328	SW	42	60
1407	SW	40	55

TABLE 4 (Cont'd.)

Weather Bureau Airport Station
T. F. Green Airport
Hillsgrove, R. I.
HURRICANE OF SEPTEMBER 11, 1954
(TIME---EST)

On September 11, 1954, Hurricane "Edna" passed to the Southeast of Rhode Island across outer Cape Cod, causing little additional property damage than had already been inflicted by hurricane "Carol" just 11 days before. However, heavy rains associated with this storm caused several rivers to flood their banks on the day after the storm, particularly in the Northeast corner of the State, and this resulted in additional property damage, running into the thousands of dollars.

Rainfall, associated with the storm, began as a very light drizzle at 5:50 P.M. on the 10th, and then changed to very heavy rain on the morning of the 11th, with the rain ending at 3:40 P.M. The total rainfall from the storm was 4.37 inches, with 3.42 inches of this falling between 7:45 A.M. and 1:30 P.M.

The lowest Sea Level Pressure was 28.73 inches at 1:25 P.M.

Maximum amounts of rainfall for short periods of time are listed below:

5 min. - .20	20 min. - .45	60 min. - 1.02	120 min. - 1.71
10 min. - .29	30 min. - .73	80 min. - 1.20	150 min. - 1.94
15 min. - .33	45 min. - .79	100 min. - 1.37	180 min. - 2.10

Winds increased to Gale Force (40 mph or over) by 1:15 p.m., with sustained Gale winds lasting until 3:30 P.M. There was no period of sustained hurricane winds, although gusts did reach hurricane force for a short while between 2:00 P.M. and 3:00 P.M. The winds began to increase from the North-Northeast, and then backed around through the Northwest and West and finally into the Southwest as the storm center passed well to the east of this station. The highest observed one-minute wind speed was 55 m.p.h., with a Peak Gust of 79 m.p.h. from the Northwest at 2:44 P.M.

Pertinent wind data are listed in the table below:

Time (E.S.T.)	Direction	One-Minute Wind Speed (m.p.h.)	Gusts (m.p.h.)
0828	NNE	15	--
0928	NNE	18	24
1028	NNE	27	34
1128	NNE	33	39
1228	NNE	34	42
1313	NNW	41	53
1328	NNW	48	64
1343	NNW	45	64
1358	NT	45	63
1413	NT	48	64
1428	NNW	50	70
1444	NT	55	79
1457	NNW	52	73
1512	NNW	46	58
1528	NNW	42	52
1627	NNW	33	45
1727	W	24	38
1826	WSW	23	32
1927	WSW	20	30
2026	SW	20	27
2127	SW	21	28
2226	WSW	18	--

TABLE 5

U. S. Weather Bureau

Nantucket Island, Mass. - August 31, 1954WIND DATA

<u>Time</u> (E.S.T.)	<u>Direction</u>	<u>One-Minute</u> <u>Wind Speed</u> (m.p.h.)	<u>Gusts</u> (m.p.h.)
0500	NE	20	-
0555	ENE	20	30
0625	ESE	25	30
0707	ESE	28	35
0802	ESE	48	58
0825	ESE	50	69
0832	ESE	50	77
0853	SE	52	65
0925	SE	48	60
1005	SE	50	65
1100	SSE	45	62
1125	S	55	73
1205	SSW	50	65
1225	SSW	50	60
1305	SSW	47	58
1400	SW	38	52
1500	SW	35	47
1600	SSW	28	44
1705	SW	29	40

One-minute wind speed - 55 m.p.h. at 1125 - N
 Peak Gust - 73 m.p.h. at 1125 - N

Nantucket Island, Mass. - September 11, 1954

0626	SE	24	36
0726	SE	31	42
0828	ESE	33	46
0926	E	45	60
1004	E	50	75
1028	E	45	72
1100	ESE	50	72
1127	ESE	50	71
1201	SSE	52	74
1225	SSE	52	72
1250	SSE	60	81
1305	SSE	60	90
1326	SSE	60	88
1403	SW	55	80
1429	SW	40	65
1509	WNW	40	60
1526	WNW	40	65
1626	WNW	40	60
1729	W	35	50
1828	W	30	38

One-minute wind speed - 73 m.p.h. at 1305 - SE
 Peak Gust - 90 m.p.h. at 1305 - SSE

TABLE 6

Logan International Airport - Weather Bureau - East Boston, Mass.

August 31, 1954

Hurricane "Carol" moved north-northeastward from the Cape Hatteras area, entering southern New England on the morning of the thirty-first, and thence swooping northward into the St. Lawrence Valley early on September 1.

The course of the center of the storm extended across Rhode Island, eastern Massachusetts, and northward along the Maine-New Hampshire border; areas traversed suffered damage comparable to the September 1938 Hurricane, but loss of life was much less.

The Boston area was swept by whole gale winds from approximately 9:37 A.M. to 2:30 P.M.; by hurricane force winds from approximately 10:33 A.M. to 12:07 P.M. Gusts of hurricane force were observed between 9:56 A.M. to 12:34 P.M. The peak gust of 100 m.p.h. was observed at 11:26 A.M.; other high gusts were 97 m.p.h. at 11:37 A.M., 96 m.p.h. at 11:21 A.M., 94 m.p.h. at 11:15 A.M., 93 m.p.h. at 11:31 A.M., and 92 m.p.h. at 10:33 A.M. and again at 11:28 A.M. All times are Eastern Standard Time.

These violent winds caused tremendous property damage, and very severe damage to utility lines and trees in Boston and suburban communities; beach-front areas were also hard hit by the storm tide.

Preliminary estimates show that the total damage will run into many millions of dollars for Boston and vicinity. Numerous injuries were attributed to the storm in and around Boston. Interruptions in electric and telephone service were widespread and prolonged, and airline, highway, railroad, and marine traffic were seriously crippled. The Hurricane brought very heavy rainfall, with excessive precipitation occurring between 9:25 A.M. and 10:00 A. M.

TABLE 6 (Cont'd.)

WIND DATA

August 31, 1954

<u>Time</u> (E.S.T.)	<u>Direction</u>	<u>One-Minute</u> <u>Wind Speed</u> (m.p.h.)	<u>Gusts</u> (m.p.h.)
0810	ENE	39	48
0824	ENE	37	43
0828	ENE	38	44
0833	ENE	30	50
0837	ENE	44	50
0840	ENE	40	50
0845	ENE	38	50
0857	ENE	42	56
0912	ENE	44	59
0927	ENE	42	56
0936	ENE	54	66
0943	ENE	59	71
0958	ENE	52	78
1013	ENE	51	68
1014	E	63	69
1026	E	70	78
1033	ESE	77	92
1045	ESE	69	89
1100	ESE	72	84
1115	SE	60	87
1120	SE	82	97
1128	SE	86	100
1145	SE	77	97
1200	SSE	64	90
1215	SSE	60	80
1225	SSE	56	72
1236	SSE	57	73
1300	S	50	67
1328	SSW	52	65
1342	SSW	57	65
1359	SSW	47	65
1400	SSW	58	65
1428	SSW	49	63
1500	SSW	40	59
1528	SSW	32	48
1555	SW	33	41
1628	SW	27	51
1656	SW	37	45
1728	SW	35	42
1757	SW	27	34
1828	SW	20	--

TABLE 6 (Cont'd.)

Logan International Airport - Weather Bureau - East Boston, Mass.

September 11, 1954

Hurricane "Edna", the second hurricane to visit this part of the country within a period of less than two weeks, struck on Saturday, the 11th, affecting this area from middle morning to late evening. Terrontial rains accompanied this latest hurricane causing considerable water damage. Rainfall due to the storm amounted to 5.64 inches, the greatest 24-hour ever recorded in September, or in any other month with a single exception - 6.04 inches in July 1921. Precipitation was excessive from 5 minutes to 180 minutes.

Hurricane "Edna" passed over southeastern New England in the early afternoon of September 11, the center moving over Marthas Vineyard from the south-southwest and preceeding north-northeast to the vicinity of Eastport, Maine. From thence, it preceeded on through New Brunswick, Canada. The average speed of Hurricane "Edna" through New England was about 35 m.p.h.

During the storm's peak the sustained one-minute wind speed was 74 m.p.h., while gusts of 87 m.p.h. were recorded. The Boston area was swept by whole gale winds from approximately 1:28 P.M. to 5:25 P.M.; by hurricane force winds from approximately 3:50 P.M. to 4:15 P.M. The peak gust of 87 m.p.h. from the northwest was recorded at 3:55 P.M. Gusts of hurricane force were recorded from 3:08 P.M. to 4:35 P.M. All times are Eastern Standard.

TABLE 6 (Cont'd.)

WIND DATA

September 11, 1954

<u>Time</u> (E.S.T.)	<u>Direction</u>	<u>One-Minute</u> <u>Wind Speed</u> (m.p.h.)	<u>Gusts</u> (m.p.h.)
0900	ENE	9	-
0915	ENE	17	-
0928	NE	19	25
0945	ENE	26	33
1000	ENE	27	33
1005	ENE	27	33
1015	ENE	28	34
1020	ENE	27	34
1028	ENE	33	37
1034	ENE	32	39
1045	ENE	31	40
1100	ENE	33	40
1105	ENE	36	44
1115	ENE	34	45
1128	ENE	41	49
1142	ENE	46	52
1150	ENE	53	60
1151	NE	54	60
1153	NE	47	60
1200	NE	47	60
1215	NE	46	58
1228	NE	46	58
1240	NE	45	58
1300	NE	50	58
1315	NE	50	59
1328	NE	53	60
1329	NE	59	64
1345	NNE	44	62
1358	NNE	43	50
1415	NNE	42	55
1428	NNE	39	61
1445	NNE	47	62
1500	NNE	53	65
1515	NE	60	74
1528	NE	70	81
1545	NE	62	80
1548	NE	68	81
1555	NE	73	87
1600	NE	60	87
1611	NE	74	86
1615	NE	54	86
1628	NE	44	73
1643	NE	45	56
1704	NE	32	56
1728	E	28	46
1754	E	35	40
1802	E	28	46

TABLE 7

U. S. Weather Bureau Station

Portland City Airport - August 31, 1954

Hurricane "Carol" caused one death in Portland, one at Port Clyde, and one at Columbia Falls. Many hundreds of trees fell. Eye of storm passed west of Portland, moving from Concord, New Hampshire, to near Bethel, Maine. These were highest winds ever recorded in August.

WIND DATA

<u>Time</u> (E.S.T.)	<u>Direction</u>	<u>One-Minute</u> <u>Wind Speed</u> (m.p.h.)	<u>Gusts</u> (m.p.h.)
0804	ENE	20	32
0900	ENE	30	48
1030	ENE	36	45
1110	ENE	43	65
1128	ENE	36	58
1210	E	45	61
1230	E	48	65
1304	E	60	76
1327	E	55	78
1412	ESE	45	68
1430	ESE	60	74
1510	ESE	56	68
1530	ESE	38	55
1600	ESE	28	47
1630	N	25	50
1700	SSW	28	40
1729	S	25	42
1805	SW	22	37

One-minute wind speed - 69 m.p.h. at 1310 - E
Peak Gust - 78 m.p.h. at 1321 - E

Portland City Airport - September 11, 1954

Hurricane Edna brought the greatest amount of rain ever to fall in one day. Caused 8 deaths, all by drowning, \$7,000,000 damage in Maine. Storm passed along parallel to coastline, about 80 miles at sea. These were highest winds ever recorded in September:

<u>Time</u> (E.S.T.)	<u>Direction</u>	<u>One-Minute</u> <u>Wind Speed</u> (m.p.h.)	<u>Gusts</u> (m.p.h.)
1129	ENE	18	38
1225	NE	23	32
1300	NNE	20	28
1325	NNE	25	40
1405	NNE	29	46
1425	NNE	26	42
1500	N	45	56
1529	N	45	61
1545	N	45	50
1607	NNW	30	48
1629	NNW	37	58

TABLE 7 (Cont'd.)

<u>Time</u> (E.S.T.)	<u>Direction</u>	<u>One-Minute</u> <u>Wind Speed</u> (m.p.h.)	<u>Gusts</u> (m.p.h.)
1712	NNW	35	57
1729	NW	40	67
1804	NW	40	58
1829	NW	25	42
1928	NW	24	40
2000	WNW	20	35
2030	W	18	32

One-minute wind speed = 60 m.p.h. at 1733 = NW
Peak Gust = 74 m.p.h. at 1740 = NW

7. Tidal heights. - Tidal heights for the two storms were obtained at selected locations along the coastal area affected. Table 8 gives readings as recorded on Coast and Geodetic gages at primary stations between New York, N. Y., and Eastport, Maine. Table 9 gives local readings at various harbors along the coast.

TABLE 8

TIDAL HEIGHTS - FROM COAST AND GEODETIC SURVEY GAGES

Location	Date	Time E.S.T.	Elevation above M.L.W. Carol	Edna	Predicted Tide	Time	Remarks
Willels Pt., N.Y.	31 Aug 54	1236	12.5*	-	7.7	1246	*Gage inoperative; highest tide not recorded
	11 Sep 54	1018	-	10.0	7.8	0933	
Montauk, N.Y.	31 Aug 54	1030	8.9	-	2.2	1035	
	11 Sep 54	1142	-	4.6	2.2	0719	
New London, Ct.	31 Aug 54	0936	7.9*	-	2.9	1055	*Gage inoperative; highest tide not recorded
	11 Sep 54	0824	-	4.4	2.9	0739	
Newport, R.I.	31 Aug 54	-	-	-	4.0	0917	Gage inoperative
	11 Sep 54	-	-	-	4.0	0604	Gage inoperative
Woods Hole, Mass.	31 Aug 54	1000	6.4*	-	1.5	1002	*Gage inoperative; highest tide not recorded
	11 Sep 54	1354	-	4.9	1.5	0649	
Boston, Mass.	31 Aug 54	1200	13.1	-	9.9	1253	
	11 Sep 54	1000	-	11.0	9.6	0938	
Portsmouth, N.H.	31 Aug 54	1248	11.3	-	8.0	1258	
	11 Sep 54	1000	-	8.9	7.8	0944	
Portland, Me.	31 Aug 54	1300	12.4	-	9.1	1238	
	11 Sep 54	0948	-	10.0	8.9	0924	
Bar Harbor, Me.	31 Aug 54	1248	11.6	-	10.6	1218	
	11 Sep 54	2036	-	12.1	11.3	2121	
Eastport, Me.	31 Aug 54	1236	19.2	-	18.4	1226	
	11 Sep 54	0912	-	19.4	18.5	0914	

TABLE 9
TIDAL HEIGHTS - 31 AUGUST 1954 - (CAROL)

LOCATION	TIME OF MAXIMUM HEIGHT (E.S.T.)	ELEVATION ABOVE M.L.W.	PREDICTED TIDE ABOVE M.L.W.	TIME (E.S.T.)	SOURCE OF INFORMATION	
Greenwich, Connecticut	1315	11.2	8.0	1253	New England Division, Corps of Engineers	
Stamford, Connecticut	1310	13.8	7.8	1253	" " " " " "	
South Norwalk, Connecticut	1255	13.3	7.7	1303	" " " " " "	
Bridgeport, Connecticut	1250	12.6	7.4	1253	Harbor Master, Bridgeport, Connecticut	
Milford, Connecticut	1245	12.3	7.2	1243	United States Fish and Wildlife Service	
New Haven, Connecticut	1240	13.9	6.9	1248	New England Division, Corps of Engineers	
Clinton, Connecticut	-	11.1	5.1	1218	" " " " " "	
Saybrook, Connecticut	1200	10.8	3.8	1155	" " " " " "	
New London, Connecticut	1015	10.5	2.9	1055	Whaling City Dredge and Dock Company	
Block Island, Rhode Island	0930	8.0	3.4	0917	United States Weather Bureau	
Westerly, Rhode Island	-	13.0	-	-	New England Division, Corps of Engineers	
Wickford, Rhode Island	-	11.5	4.3	0927	" " " " " "	2
Providence, Rhode Island	-	17.9	5.1	0927	" " " " " "	
Newport, Rhode Island	1230	11.6	4.0	0917	City Engineer, Newport, Rhode Island	
Fall River, Massachusetts	-	15.6	4.9	0932	New England Division, Corps of Engineers	
New Bedford, Massachusetts						
Ft. Rodman	1115	12.8	-	-	" " " " " "	
City Dock	-	13.1	4.2	0927	" " " " " "	
Cuttyhunk, Massachusetts	-	15.8	-	-	" " " " " "	
Vineyard Haven, Massachusetts	1100	5.8	1.8	1303	Woods Hole Oceanographic Institute	
Hyannisport, Massachusetts	1230	8.5	3.3	1338	New England Division, Corps of Engineers	
Falmouth, Massachusetts	1130	9.5	1.4	1238	Woods Hole Oceanographic Institute	
Edgartown, Massachusetts	1100	9.1	2.1	1353	" " " " " "	
Brant Point, Massachusetts	no appreciable increase over normal tide				" " " " " "	
Monemsha, Massachusetts	1015	10.7	3.2	0942	" " " " " "	

TABLE 9 (CONT'D)
TIDAL HEIGHTS - 31 AUGUST 1954 - (CAROL)

<u>LOCATION</u>	<u>TIME OF MAXIMUM HEIGHT (E.S.T.)</u>	<u>ELEVATION ABOVE M.L.W.</u>	<u>PREDICTED TIDE ABOVE M.L.W.</u>	<u>TIME (E.S.T.)</u>	<u>SOURCE OF INFORMATION</u>
Chatham, Massachusetts	1345	9.9	3.7	1343	New England Division, Corps of Engineers
Provincetown, Massachusetts	1230	11.2	9.4	1308	" " " " "
Cape Cod (Buzzards Bay) Mass.	-	14.0	4.6	0932	" " " " "
Plymouth, Massachusetts	1300	12.0	10.0	1303	" " " " "
Boston, Massachusetts	1200	13.1	9.9	1253	United States Coast and Geodetic Survey
Portsmouth, New Hampshire	1248	11.3	8.0	1258	" " " " "
Portland, Maine	1300	12.4	9.1	1238	" " " " "

11 SEPTEMBER 1954 - (EDNA)

Edgartown, Massachusetts	1240	6.9	2.0	1038	Woods Hole Oceanographic Institute
Brant Point, Massachusetts	1430	6.3	3.1	1028	" " " "
Menemsha, Massachusetts	1230	4.4	3.2	0629	" " " "
Vineyard Haven, Massachusetts	1400	3.9	1.7	0948	" " " "

NOTE: See Table 8 for other tidal heights for Hurricane "Edna."

STORM EFFECTS AND LOSSES

8. General. - Hurricane CAROL was only slightly less destructive of property in the New England Coastal area than the great storm of 1938. Hurricane winds combined with destructive wave action and abnormal high tides to devastate the coastline of Rhode Island, eastern Connecticut and southeastern Massachusetts. Hurricane EDNA, with its course considerably to the east of that taken by CAROL caused relatively minor wind and tide damage, but the torrential rains accompanying this storm caused serious flooding of streams and rivers in Massachusetts, Maine and New Hampshire. Loss of life resulting from the two storms was fifty-eight, as reported by the U. S. Red Cross. Damage to Federal structures and channels and estimated losses and damage to commercial and pleasure craft, most of which resulted from CAROL, are shown in Tables 10 and 11. Estimated monetary losses resulting to commercial, industrial, private and personal property are shown in Table 12.

TABLE 10
HURRICANES CAROL AND EDNA*
DAMAGE TO GOVERNMENT STRUCTURES AND INSTALLATIONS

	<u>Structure</u>	<u>Cost to Repair</u>	<u>Channel Shoaling</u>	<u>Cost</u>
<u>CONNECTICUT</u>				
Southport	Breakwater	\$ 50,000	Entrance Channel	\$ 25,000
Bridgeport	Fayerweather Breakwater	75,000	-	-
Milford	East Jetty	35,000	Entrance Channel	30,000
Clinton	-	-	Channel and Anchorage	50,000
Duck Island	Breakwater	35,000	-	-
Saybrook	Breakwater	25,000	Channel, outer bar	25,000
Stonington	Breakwater	50,000	-	-
		<u>\$270,000</u>		<u>\$130,000</u>
<u>RHODE ISLAND</u>				
Pt. Judith	West Breakwater	\$ 10,000	Channel	50,000
	Main Breakwater	150,000		
	East Breakwater	250,000		
Block Island				
Harbor of Refuge	Main Breakwater	10,000	Entrance Channel	50,000
Great Salt Pond	South Jetty	10,000	-	-
		<u>\$430,000</u>		<u>\$ 100,000</u>
<u>MASSACHUSETTS</u>				
Menemsha Creek	West Jetty	\$ 15,000	Channel	\$ 50,000
	East Jetty	10,000	-	-
Edgartown Harbor	-	-	Channel	50,000
Hyannis Harbor	Breakwater	50,000	-	-
Provincetown Harbor	Breakwater	25,000	-	-
Boston Harbor			-	-
Deer Island	Seawall	40,000	-	-
		<u>\$140,000</u>		<u>\$ 100,000</u>
<u>MAINE</u>				
Kennebunk River	Breakwater	5,000	-	-
Isle of Shoals	Breakwater	10,000	-	-
		<u>\$ 15,000</u>		
GRAND TOTALS		\$855,000		\$ 330,000

*Damage to Government structures in New England coastal area is negligible from storm of September 11.

TABLE 10 - (CONT'D.)

NOTE: Damage to Coast Guard facilities and installations, most of which were on shore, is estimated to be \$896,050. This damage was caused mostly by hurricane Carol, in the amount of \$791,900. Damage to Navy installations is estimated at \$3,858,300.

TABLE 11
HURRICANES CAROL AND EDNA*
BOAT LOSSES

<u>Location</u>	<u>Type (Pleasure)</u>		<u>Value</u>	<u>Type (Commercial)</u>		<u>Value</u>	
	<u>Wrecked</u>	<u>Damaged</u>		<u>Wrecked</u>	<u>Damaged</u>		
Connecticut	65	395	\$1,000,000	10	35	390,000	
Rhode Island	400	1365	5,000,000	50	200	650,000	
Massachusetts	240	990	3,000,000	25	100	1,000,000	8
Maine	40	270	750,000	50	100	450,000	
New Hampshire	<u>10</u>	<u>45</u>	<u>150,000</u>	<u>5</u>	<u>20</u>	<u>65,000</u>	
	755	3065	\$9,900,000	140	455	\$2,555,000	

*The major part of listed damage is chargeable to Carol. Not listed above is damage to Coast Guard vessels in the area. A cutter, lightship and two buoy tenders were damaged in the August storm, in the amount of approximately \$150,000. In the September storm, one cutter received damages of about \$60,000.

TABLE 12
SHORE DAMAGE
Hurricane Carol

<u>Location</u>	<u>Commercial</u>	<u>Industrial</u>	<u>Private and Personal Property Damage</u>
Connecticut	\$ 2,910,000	\$ 5,339,000	\$13,242,000
Rhode Island	44,934,000	13,938,000	13,913,000
Massachusetts	5,063,000	17,281,000	23,015,000
New Hampshire	280,000	99,000	954,000
Maine	317,000	32,000	530,000
	<u>\$53,504,000</u>	<u>\$36,689,000</u>	<u>\$51,704,000</u>
<u>Hurricane Edna</u>			
Connecticut	\$ 489,000	\$ 205,000	\$ 2,687,000
Rhode Island	941,000	591,000	1,616,000
Massachusetts	539,000	867,000	1,343,000
New Hampshire	-	21,000	22,000
Maine	197,000	24,000	217,000
	<u>\$ 2,166,000</u>	<u>\$ 1,708,000</u>	<u>\$ 5,885,000</u>

NOTE: Estimated damage to public works (not including Federal installations) and cleanup attendant upon such damage in New England, most of which occurred in the coastal area, is \$42,738,000 for Carol and \$8,105,000 for Edna.

Estimated damage to railroad transportation facilities in New England is \$1,158,000 for Carol and \$837,000 for Edna.

Estimated damage to utilities in New England, exclusive of damage suffered by several large private power plants and transmission lines, is \$11,711,000 for Carol and \$9,565,000 for Edna.

9. Brief Description of Coastal Damage, Hurricane Carol. -

a. Connecticut. - Damage resulting from flooding caused by extreme high water at low shore areas was general along the coast. Damage from wave attack was noted between New Haven and Old Saybrook, but was particularly severe east of the Connecticut River, increasing in severity towards the Rhode Island boundary, with greatest damage at New London (\$1,000,000) and Stonington (\$5,000,000). Erosion of beaches and destruction of seawalls and other shore protective structures were not generally severe. At some locations, quantities of sand were washed landward from low beaches. At several locations beaches appeared to have benefited by accretion. The greater part of all losses throughout the state resulted from flood water and wind damage to industrial plants, business establishments, shore-front homes and cottages, and east of the Connecticut River, damage to fishing and pleasure craft, harbor facilities, destruction of shore-front homes and cottages and beach establishments. Detailed estimate of losses at only a few locations was available

b. Rhode Island. - Heavy damages from tidal flooding and wave attack occurred throughout the coastal area, with some beach developments almost completely wiped out. Hundreds of summer homes west of Pt. Judith were destroyed on their foundations or were swept off the low barrier beaches. Cliffs and dunes out of reach of ordinary wave action were eroded, and numerous breaches through the shore barriers were cut by the flood water run-off from the ponds behind the barrier beach. All natural beach grass protection was completely destroyed. Damage to seawalls, groins, and other shore protective structures was comparatively moderate, many such structures being overtopped by the extreme high tides with consequent destruction of property which they were intended to protect. Damage or total loss to boats, piers, wharves,

and shore-front buildings was widespread. Water damage in the business section of the city of Providence caused by tidal flooding during "Carol" was extremely heavy.

c. Massachusetts. - South shore and islands off the coast. - Damage from flooding and wave attack occurred throughout the entire area. Heavy damage to beaches and shore developments was limited largely to the area between Westport and Wareham, Falmouth and Hyannis, and on the island of Martha's Vineyard. Erosion of beaches and destruction or damage to shore protective structures were comparatively moderate. Heavy wave attack occurred generally at a higher level than the berms of beaches, eroding bluffs and cliffs, and sand dunes. Destruction and damage to all types of vessels were heavy and widespread, occurring at practically all harbor areas.

East shore. - Waterfront damage north of Cape Cod was caused principally by wave attack and exceptionally high water which resulted in heavy damage to small craft ranging from skiffs to expensive yachts. A large number of pleasure boats were sunk or blown ashore, with resulting destruction. Erosion of beaches and damage to shore protective structures were comparatively moderate.

d. New Hampshire. - The principal losses along the coastal area resulted from destruction of or damage to small craft and flooding of beach areas. No serious erosion of beaches or destruction of shore protective structures was reported.

e. Maine. - The principal losses along the coastal area resulted from destruction and damage to fishing and pleasure craft and fishing gear, and from flooding of low beach developments. Pleasure craft damage was reported at Portland, Camden, Casco Bay, and Lake Sebago. Seawall wash-outs were reported at Wells Beach.

10. Coastal Damage, Hurricane Edna. - New England - General -
Damage along the entire coast during hurricane Edna was comparatively moderate. The heaviest losses occurred as a result of flooding brought on by exceptionally heavy rainfall, overflowing culverts and flooded streets, with several minor wash-outs.

11. Recapitulation of Damage Caused by Hurricanes Carol and Edna. -

Damage to Federal Structures and Channels	1,215,000
Damage to Vessels (commercial & pleasure)	12,455,000
Damage to Shore Properties (public & private)	151,656,000*
Loss of Life	58

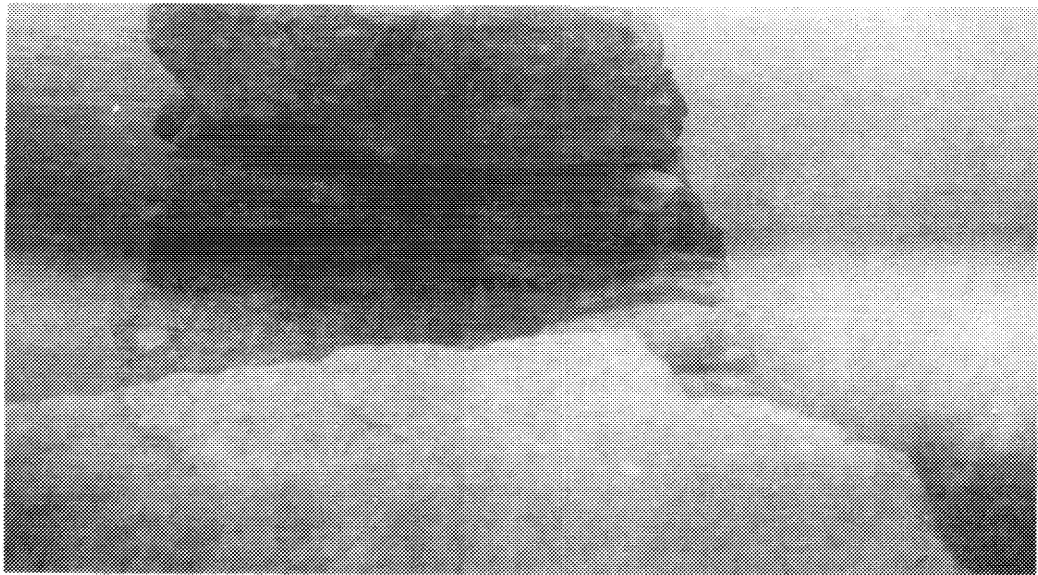
*Additional damage, in the estimated amount of \$74,114,000, was incurred by public works and public and private utilities. Segregation between coastal and inland damage is difficult in these cases, but, by far, the major portion of damage occurred in coastal areas.

12. On the following pages are scenes of damage along the coastal area. This damage is generally confined to:

- (a) Damage to government installations
- (b) Vessel damage
- (c) Shore damage

Attached map shows the general path of the two storms, as they traversed New England, and locations of government installations which were damaged.

Incl
New England Area Map



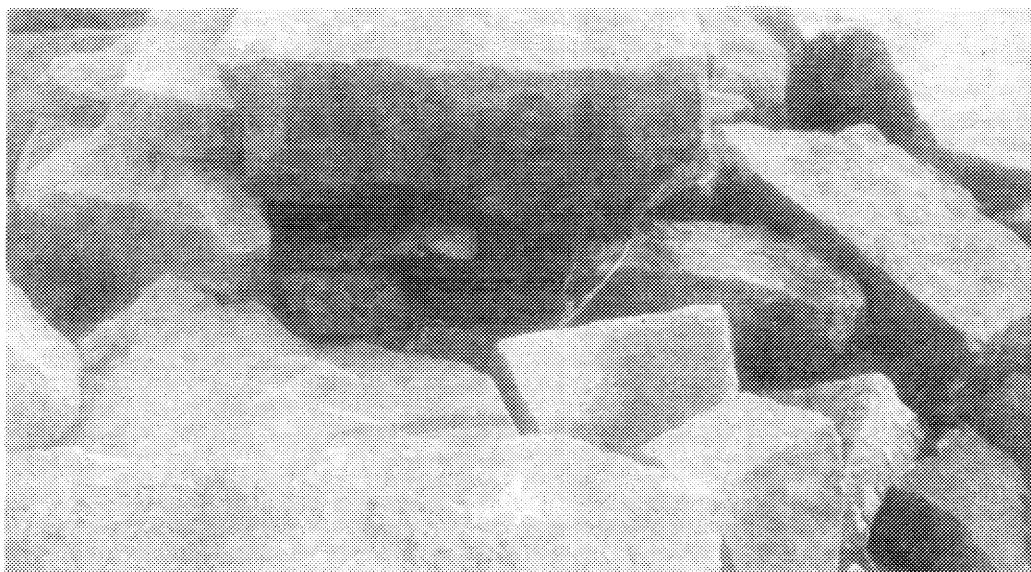
1. Southport, Connecticut, damage to breakwater.



2. Bridgeport, Connecticut, Fayerweather breakwater.



3. Bridgeport, Connecticut, Fayerweather breakwater.



4. Milford, Connecticut, East breakwater.



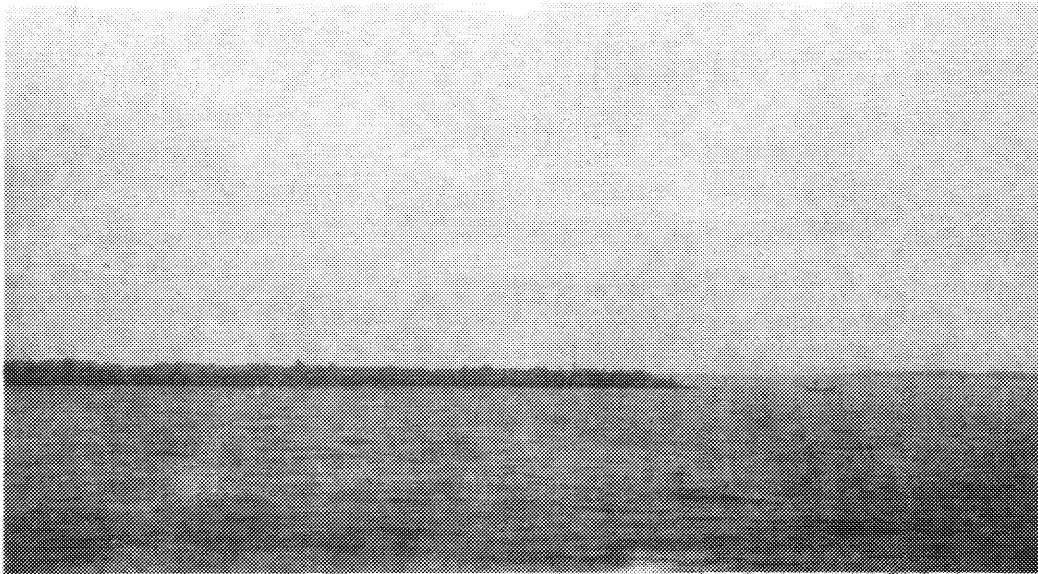
5. Milford, Connecticut, East breakwater.



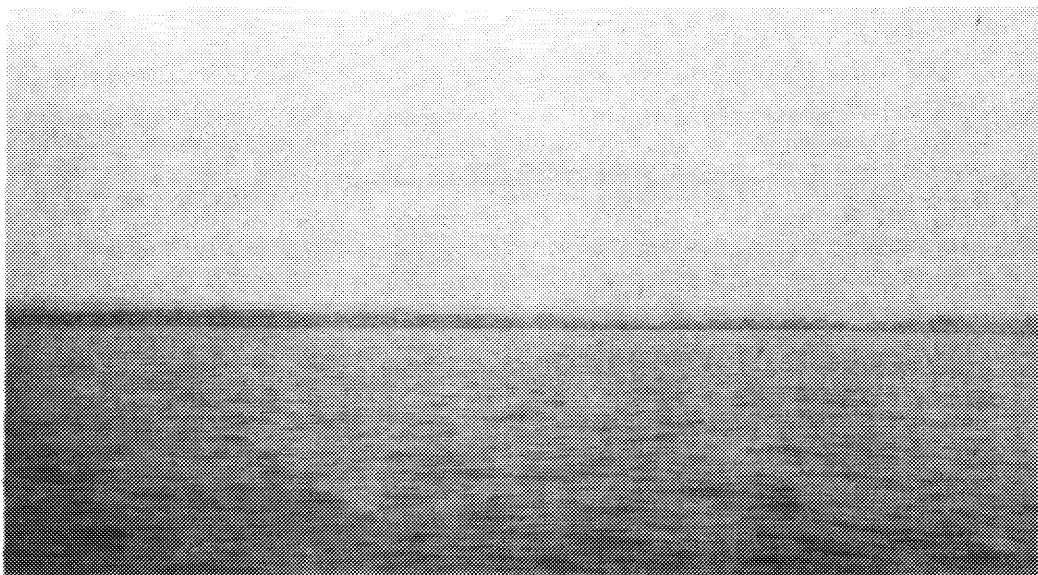
6. Saybrook, Connecticut, West breakwater.



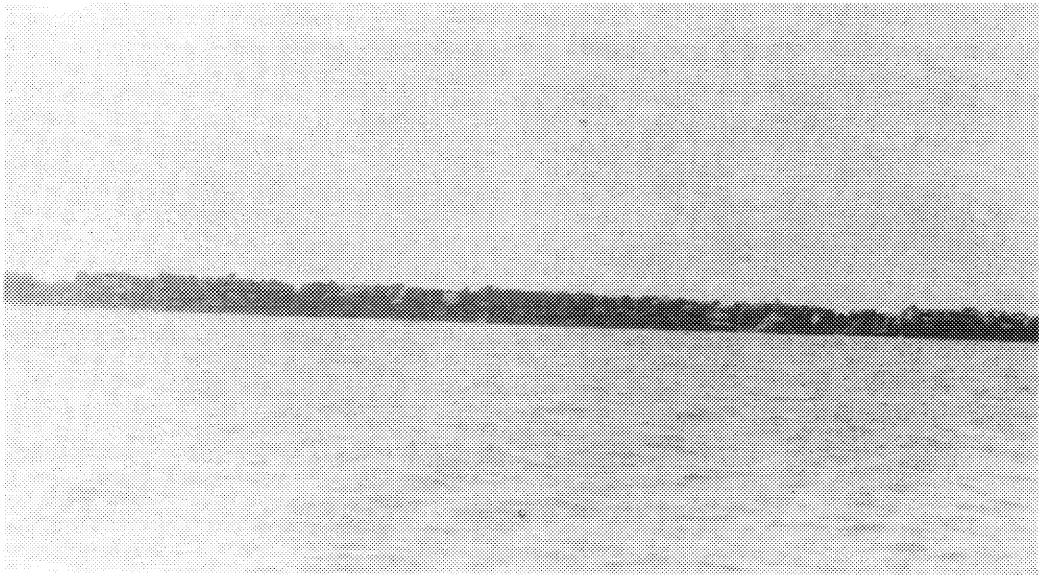
7. Saybrook, Connecticut, West breakwater, inshore end.



8. Stonington, Connecticut, East breakwater.



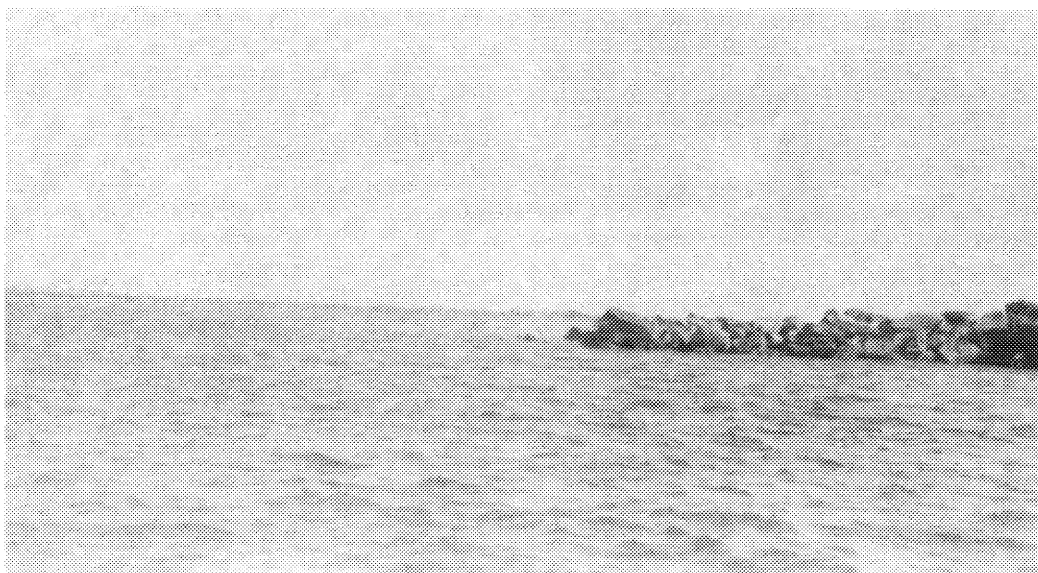
9. Stonington, Connecticut, West breakwater.



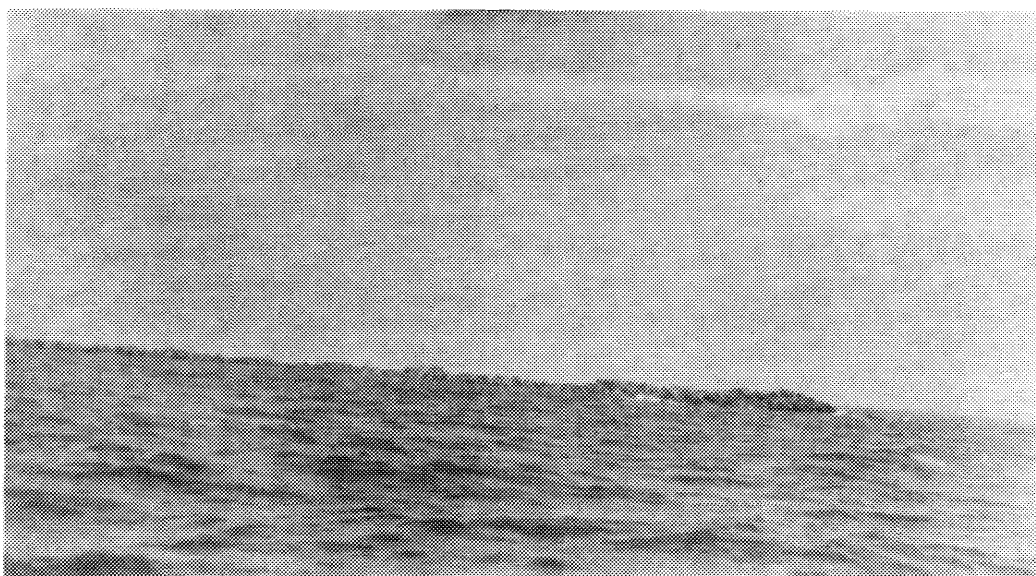
10. Point Judith, R.I., West end of Main breakwater.



11. Point Judith, R.I., Main breakwater, Center beacon
easterly.



12. Point Judith, R.I., Main breakwater, East end,
Beacon destroyed.



13. Point Judith, R.I., East Shore Arm, outer end,
Beacon destroyed.



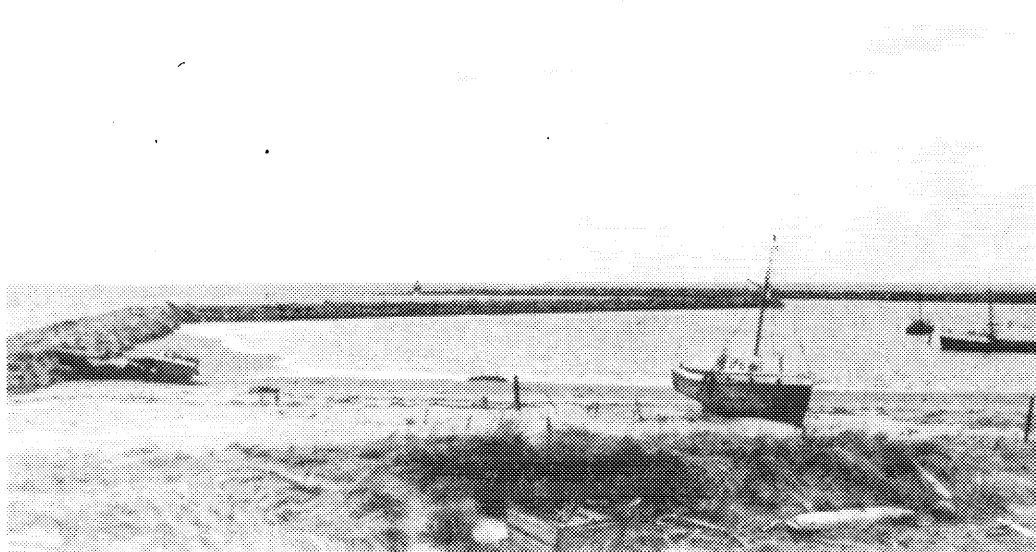
14. Point Judith, R.I., East Shore Arm, midway, looking
seaward.



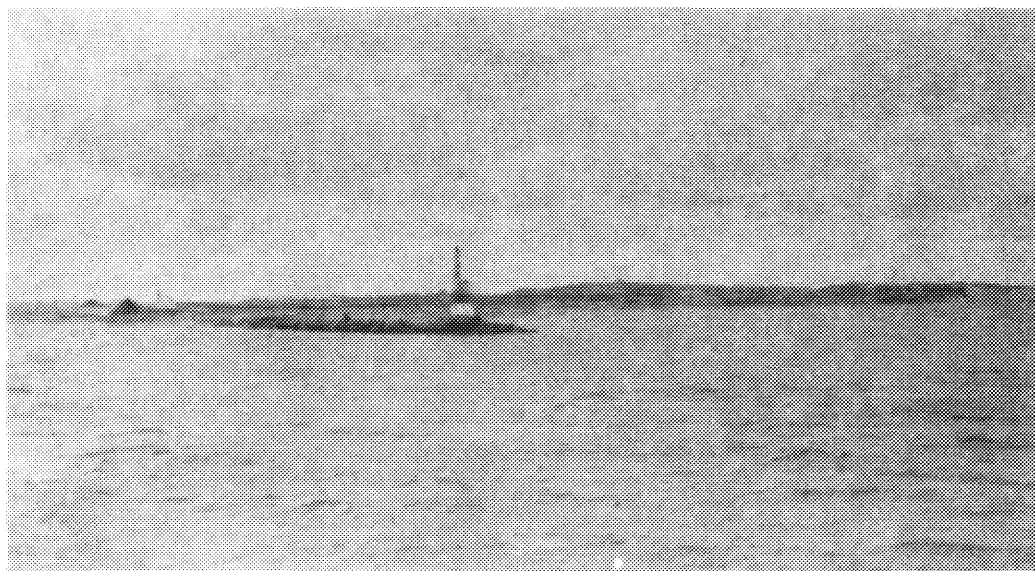
15. Point Judith, R.I., East Shore Arm, looking towards land.



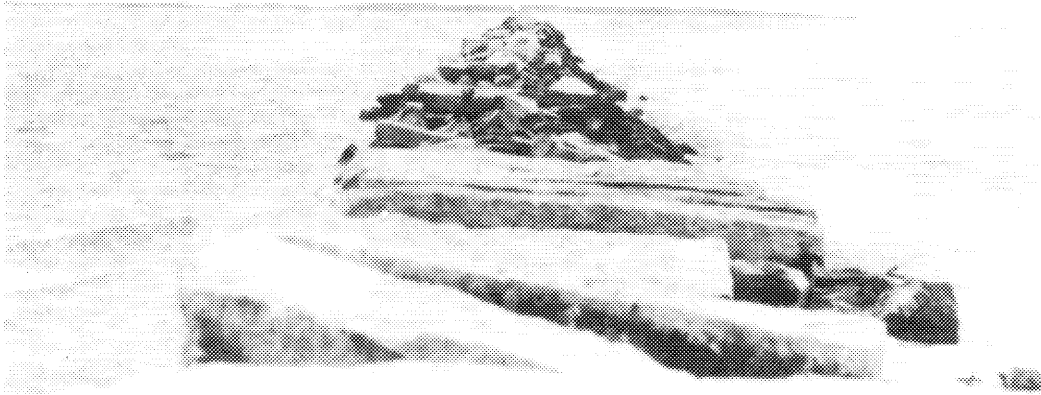
16. Point Judith, R.I., East Shore Arm, looking seaward.



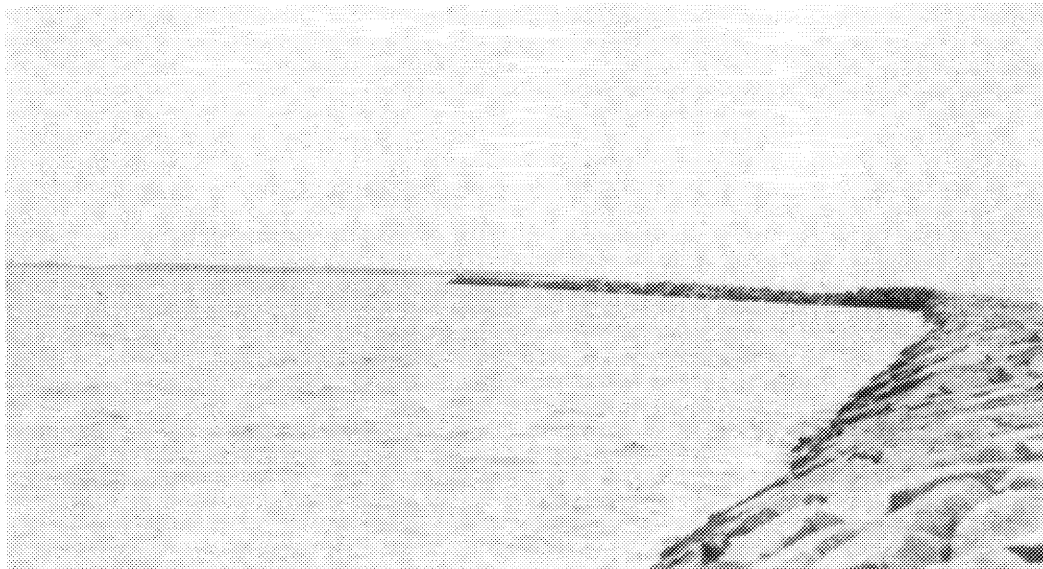
17. Block Island, R.I., Harbor of Refuge, breakwaters.



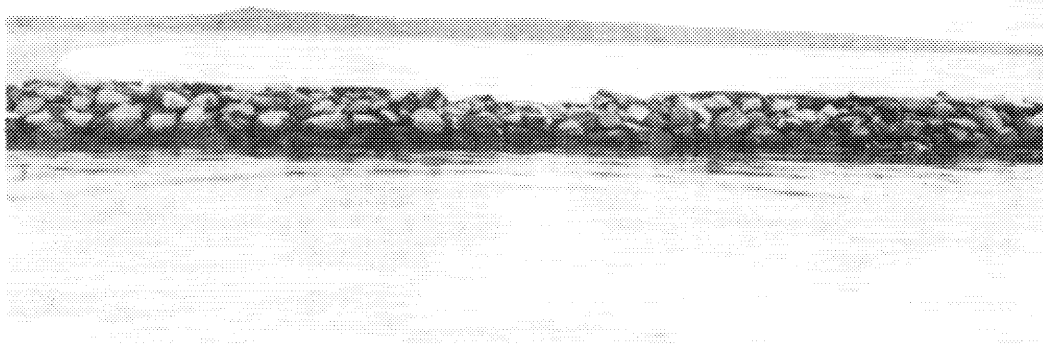
18. Block Island, R.I., Great Salt Pond, South jetty.



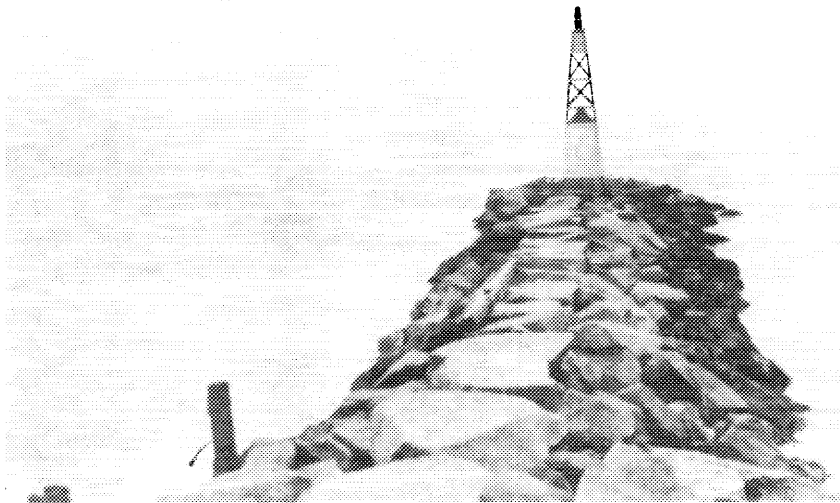
19. Hyannisport, Mass., Government jetty from State jetty.



20. Hyannisport, Mass., Government jetty from State jetty.



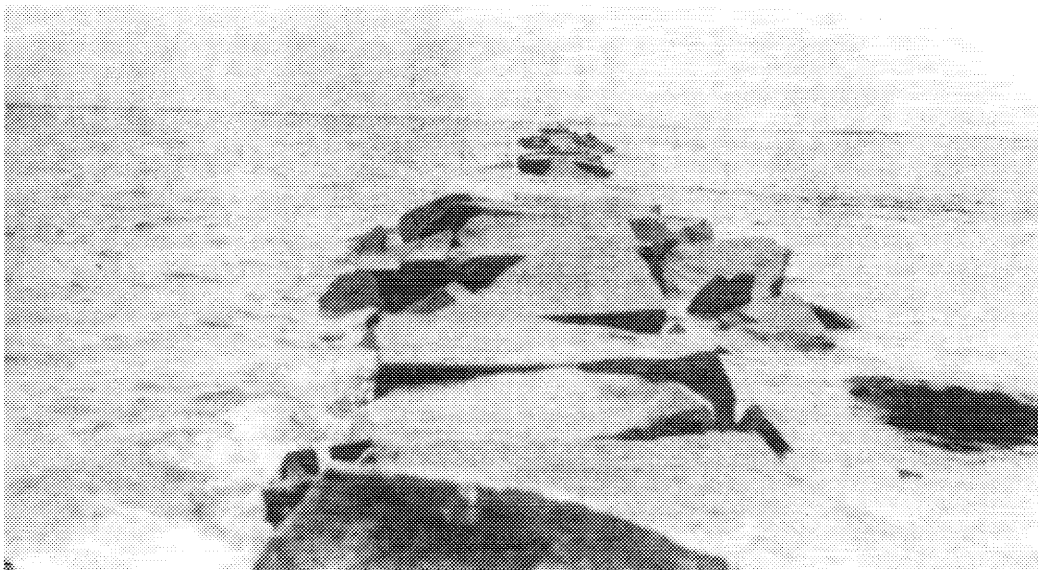
21. Menemsha, Martha's Vineyard, Mass., West jetty.



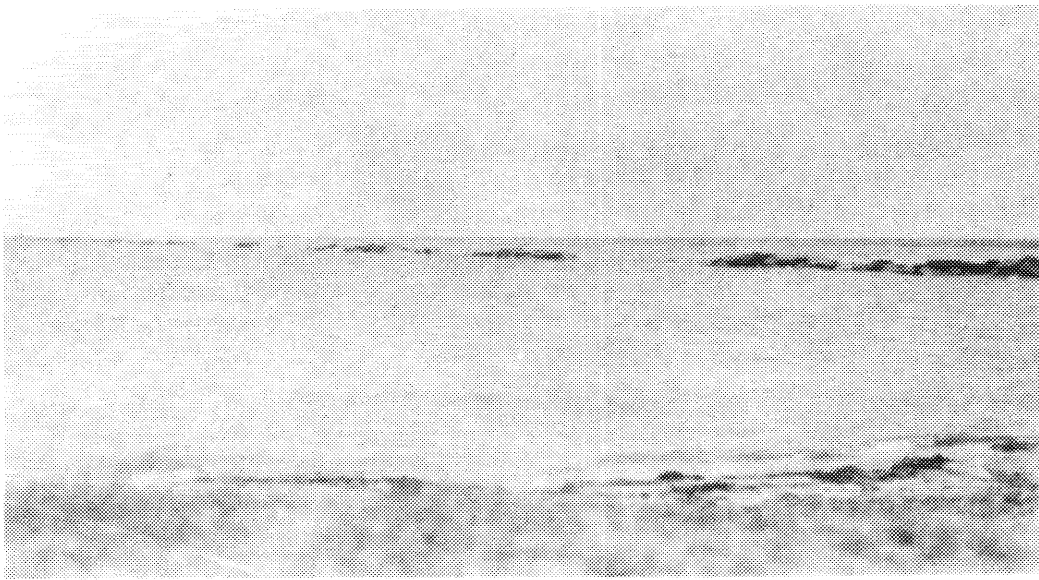
22. Menemsha, Martha's Vineyard, Mass., East jetty.



23. Menemsha, Martha's Vineyard, Mass., Wing wall from East jetty.



24. Provincetown, Mass., along breakwater.



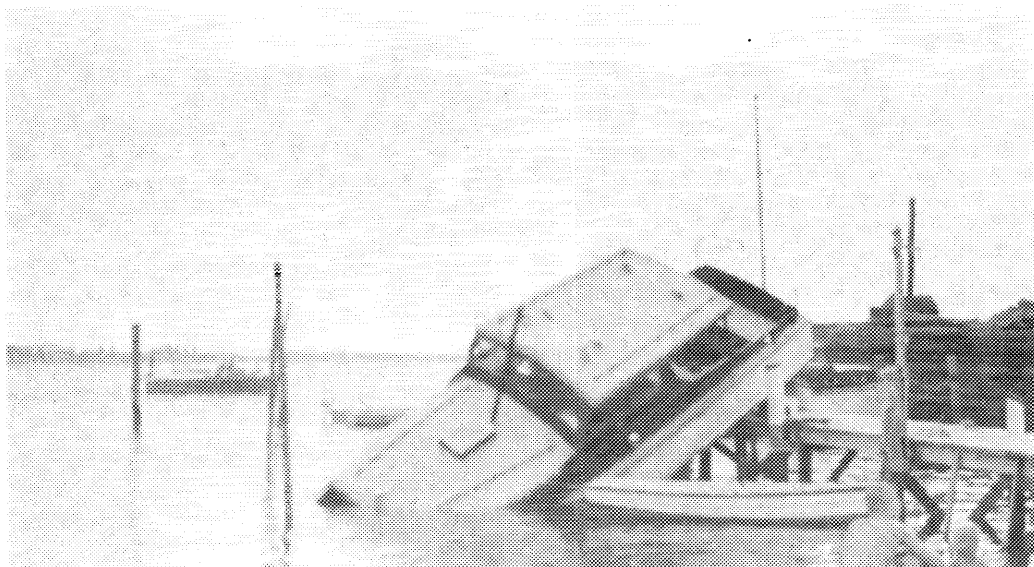
25. Provincetown, Mass., view of shore end of breakwater.



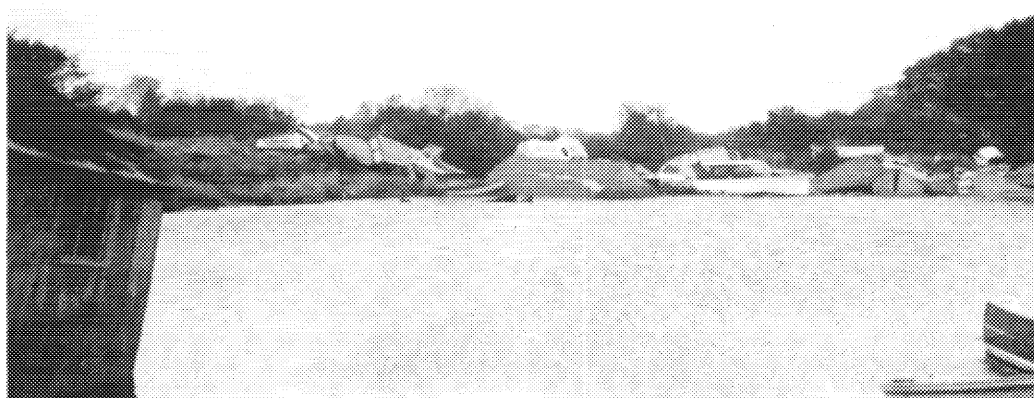
1. Watch Hill, R.I., Seawall at Coast Guard Station.



2. Watch Hill, R.I., Erosion at Coast Guard Station.



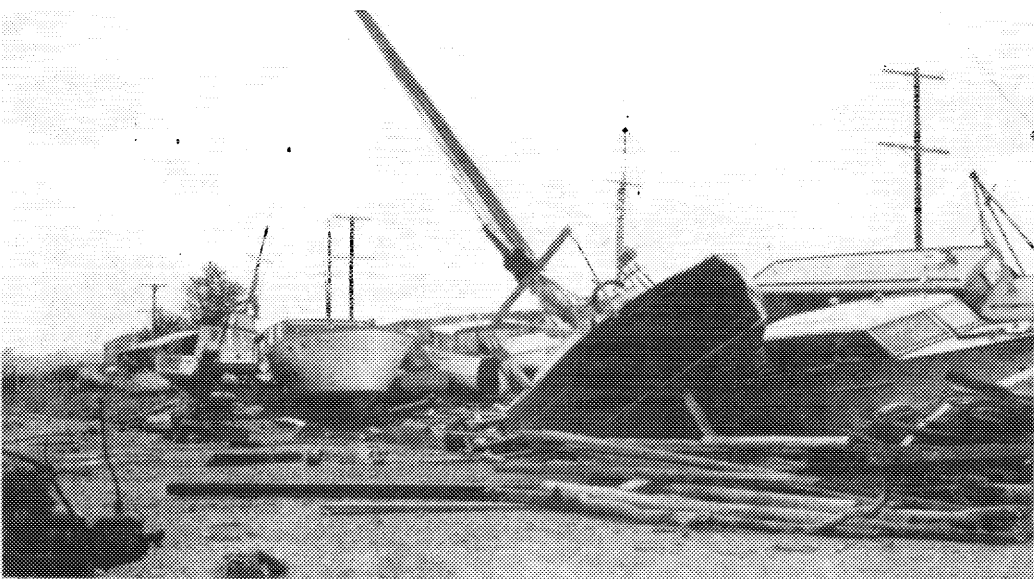
3. Jerusalem, R.I., Boats wrecked at pier.



4. Pt. Judith Pond, R.I., Wrecked boats.



5. Pt. Judith, R.I., damage to piers.



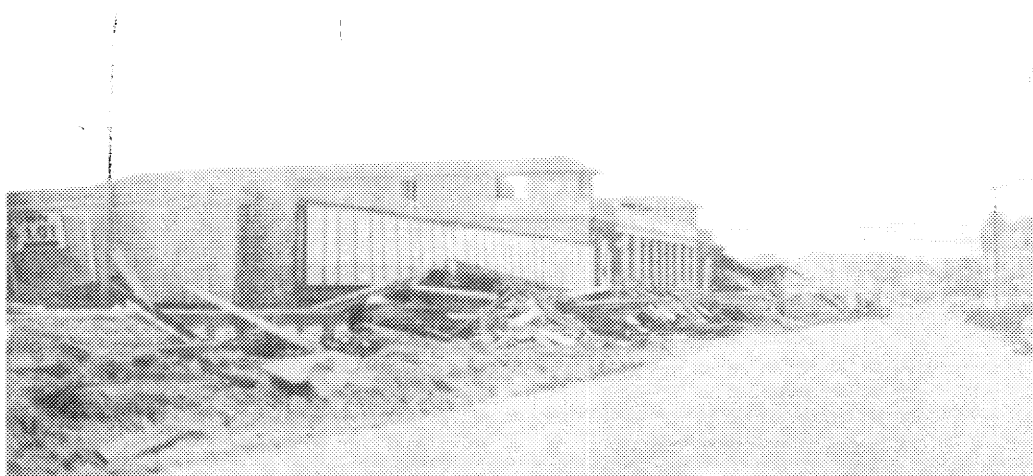
6. Pt. Judith, R.I., damage to boats.



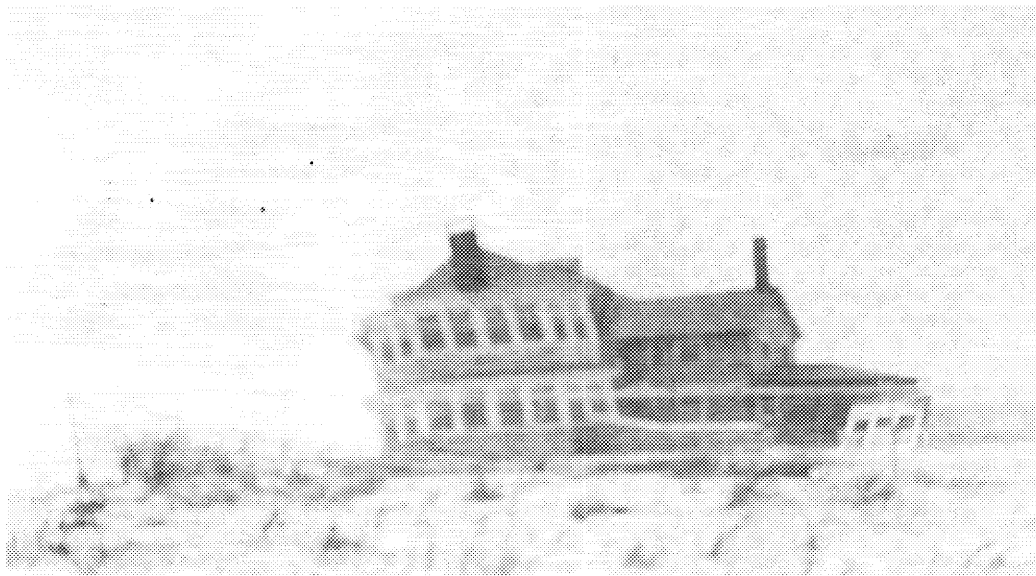
7. Galilee, R.I., State Pier.



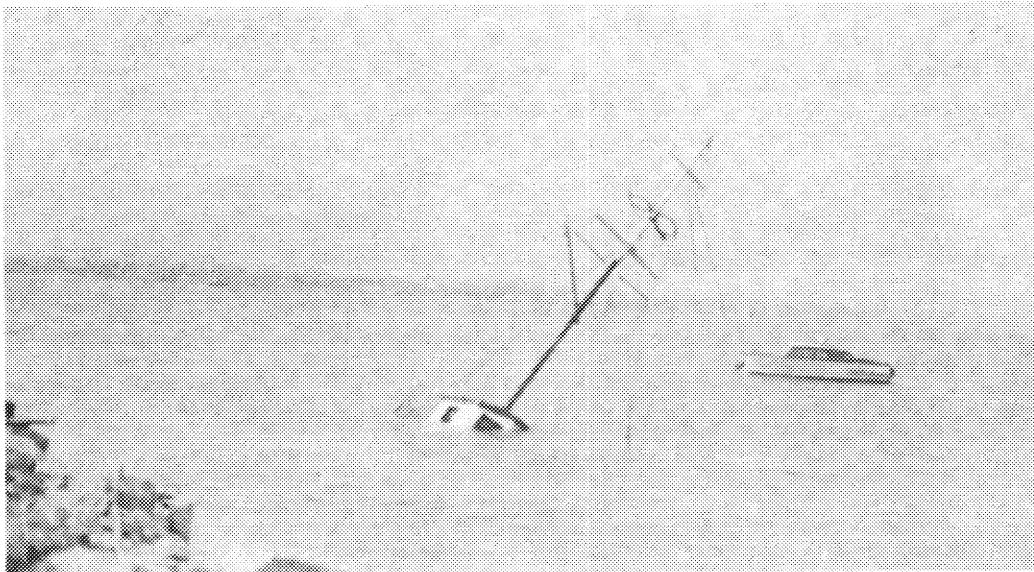
8. Galilee, R.I., Wrecked boats at piers.



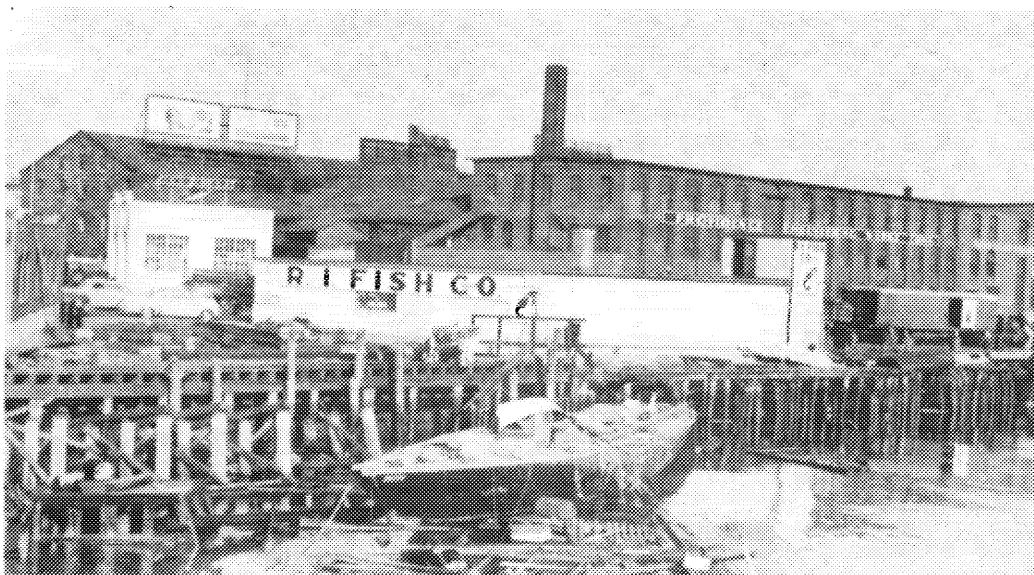
9. Narragansett, R.I., Damage to buildings.



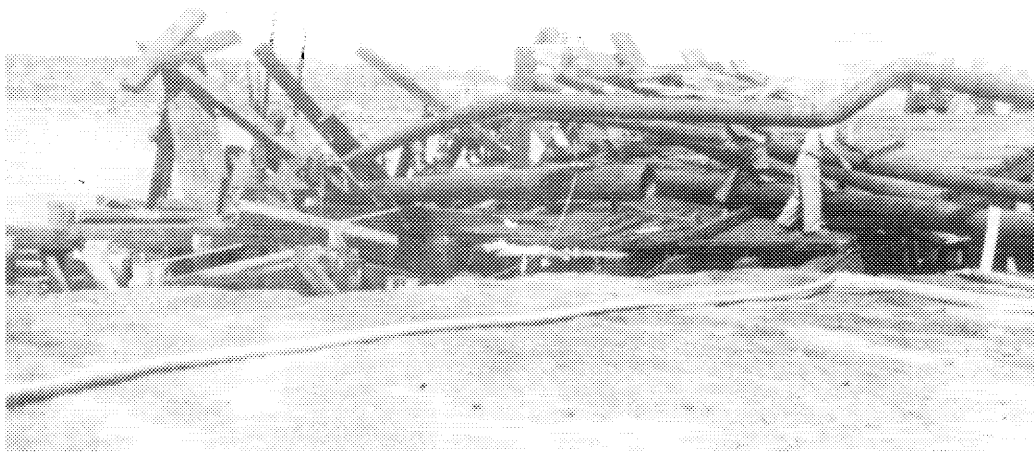
10. Narragansett, R.I., Canonchet Club.



11. Narragansett Bay, R.I., wrecked boat.



12. Providence, R.I., Damage at Point Street.



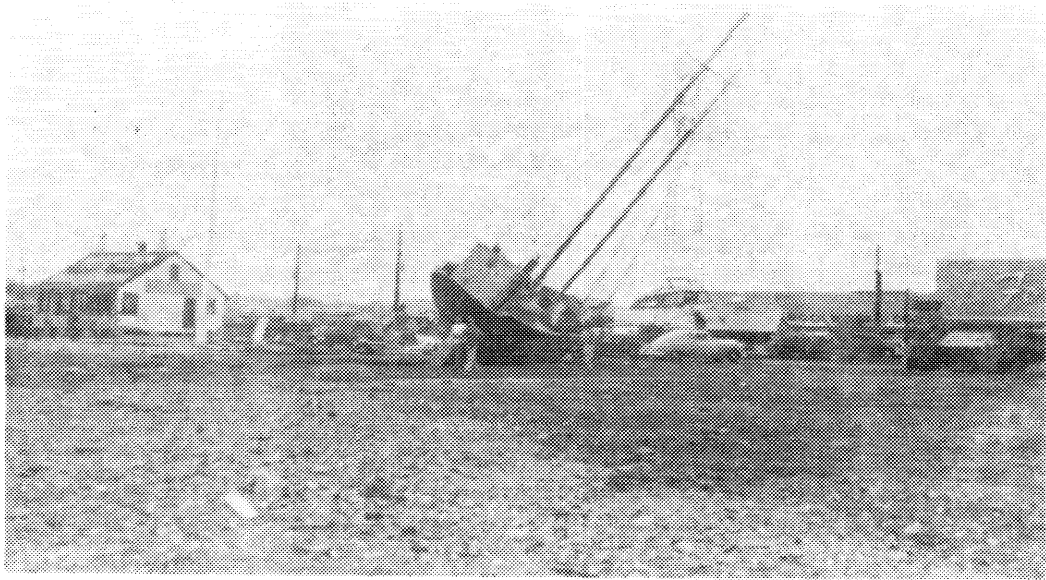
13. East Providence, R.I., Damage at Oil Pier.



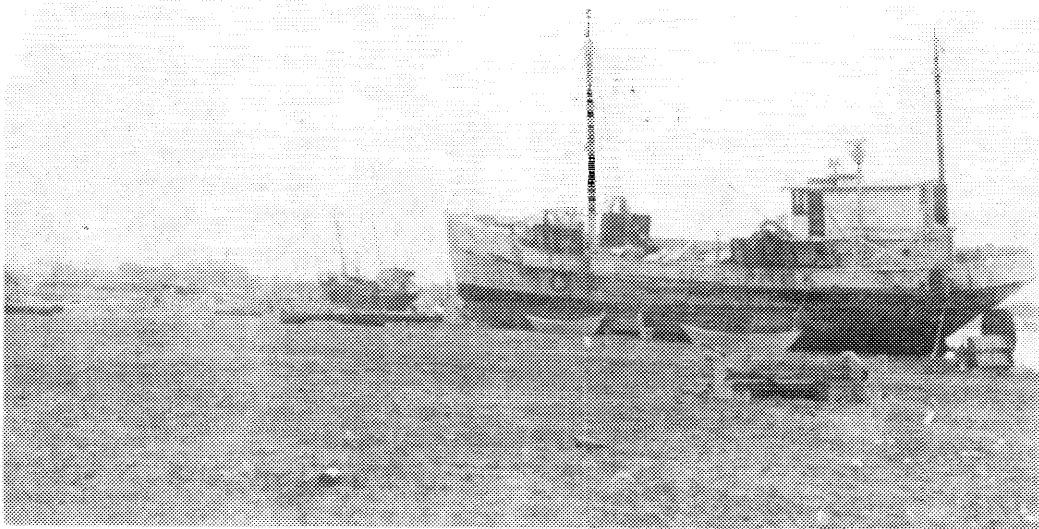
14. East Providence, R.I., Houses undermined.



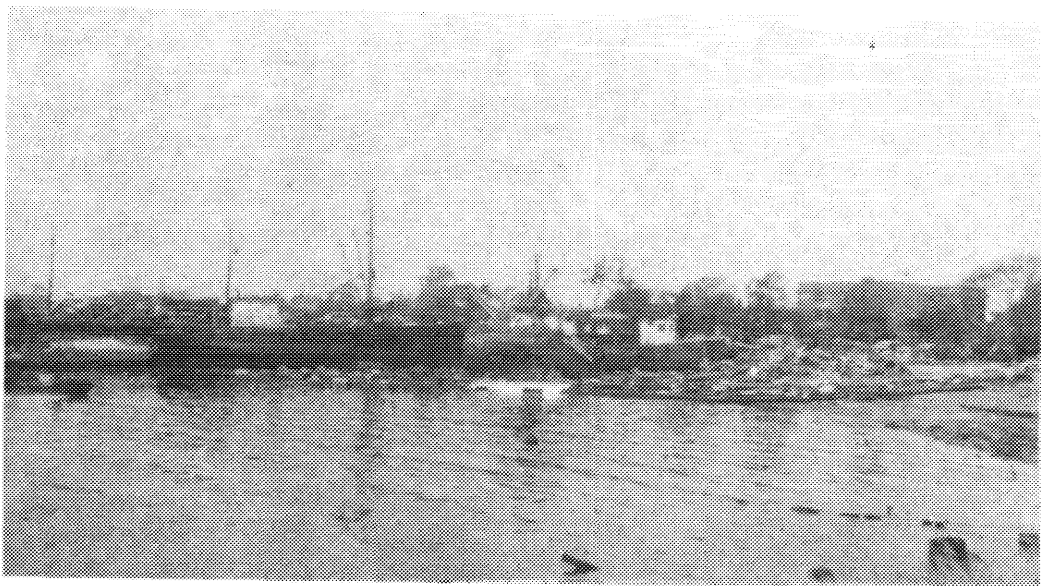
15. New Bedford, Mass., Boat Damage at Crow Island.



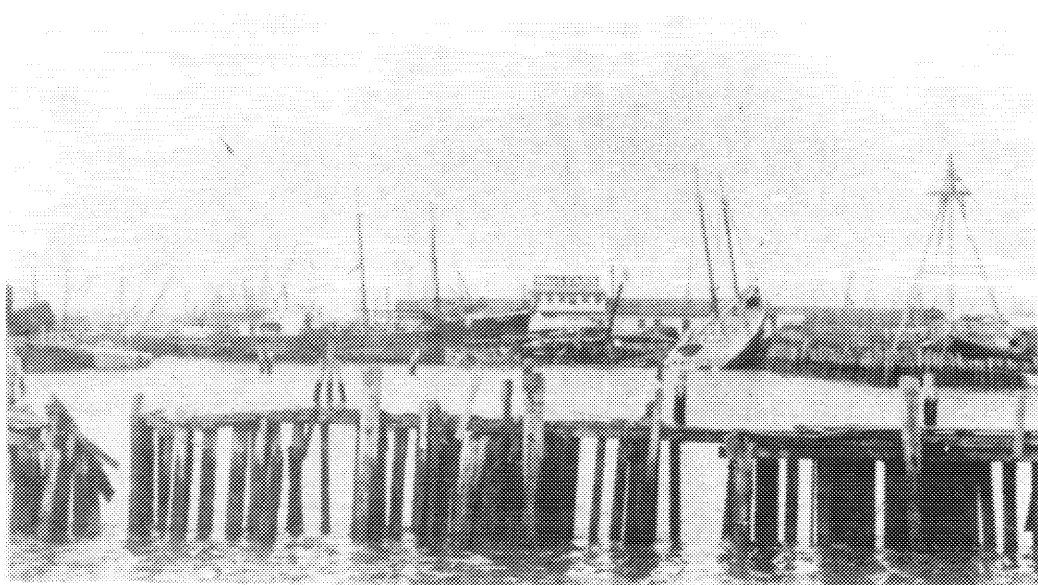
16. New Bedford, Mass., Dragger aground, Pope Island.



17. New Bedford, Mass., Dragger aground, Pope Island.



18. Fairhaven, Mass., Boat damage at causeway.



19. Fairhaven, Mass., Waterfront damage.



1. Groton, Connecticut. Shenecossett Beach swept clean of private beach club buildings.



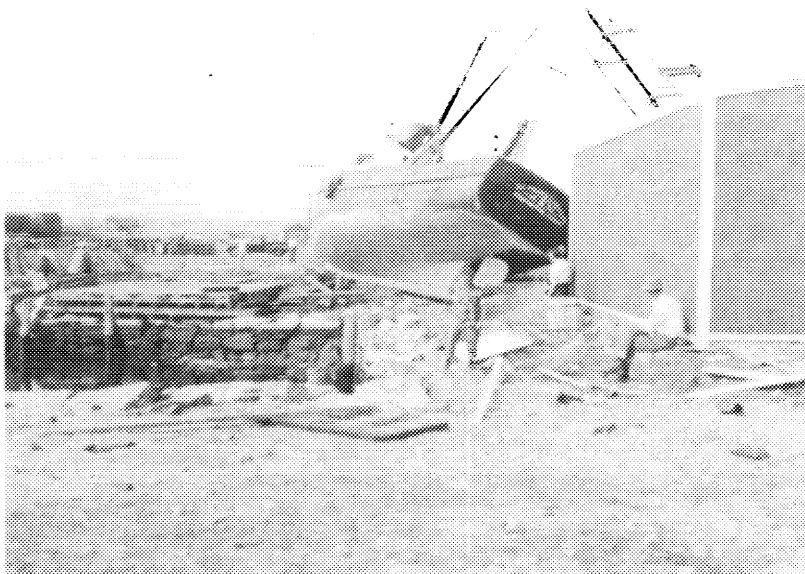
2. Groton, Connecticut. Bluff eroded at U. S. Coast Guard Training Station at Avery Point.



3. Stonington, Connecticut. Homes destroyed or damaged at Lords Point.



4. Stonington, Connecticut. Remains of homes swept from Lords Point.



5. Stonington, Connecticut. Fishing vessel left high and dry at Stonington Harbor.



6. Westerly, Rhode Island. Over 200 buildings were destroyed or washed inland at Misquamicut Beach.



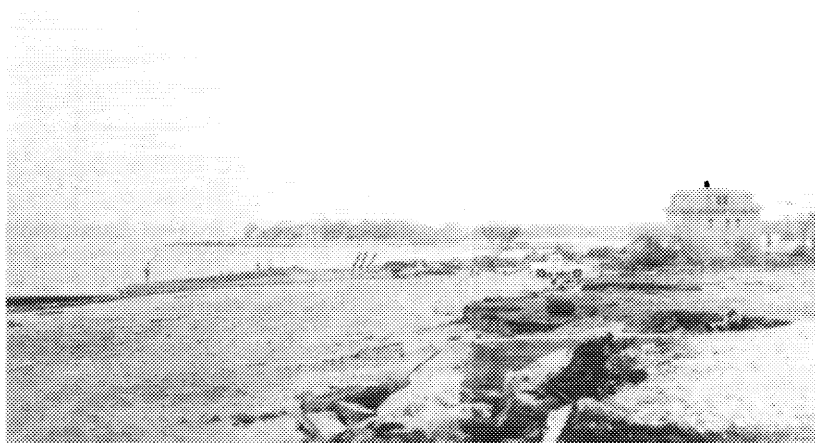
7. Westerly, Rhode Island. Wreckage piled against west jetty at Weekapaug Inlet.



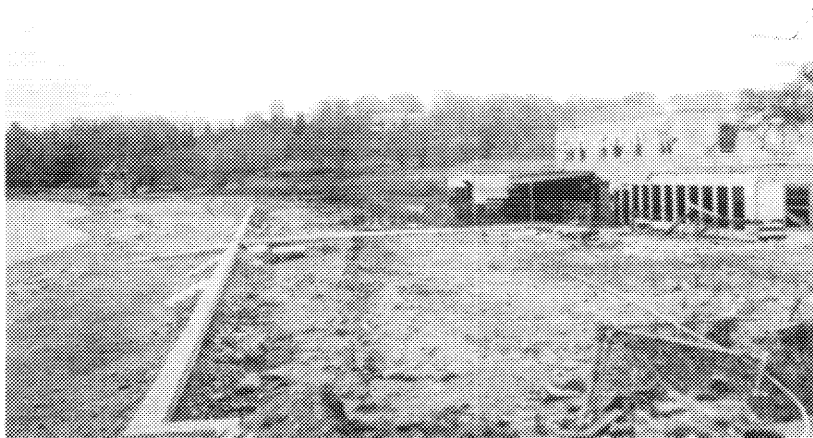
8. Narragansett, Rhode Island. Wrecked and damaged cottages at Jerusalem.



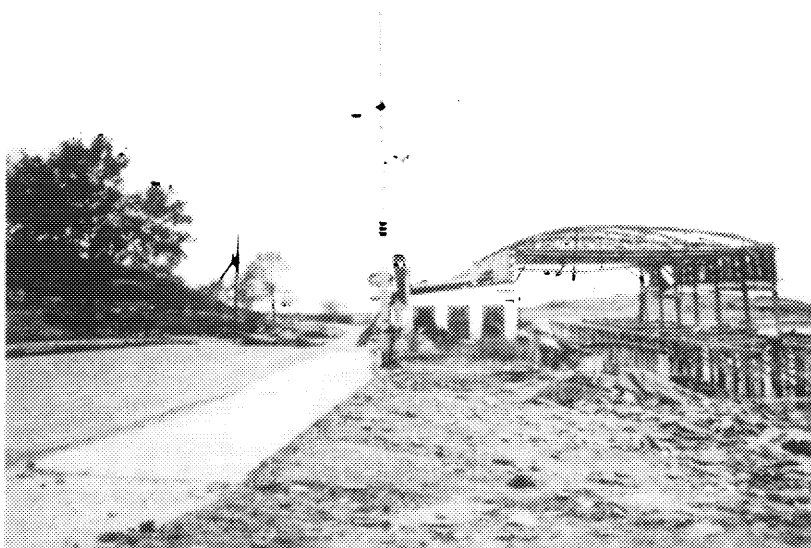
9. Narragansett, Rhode Island. Erosion and building damage looking north from Scarborough Beach.



10. Warwick, Rhode Island. Cottages occupying this area at Oakland Beach were destroyed.



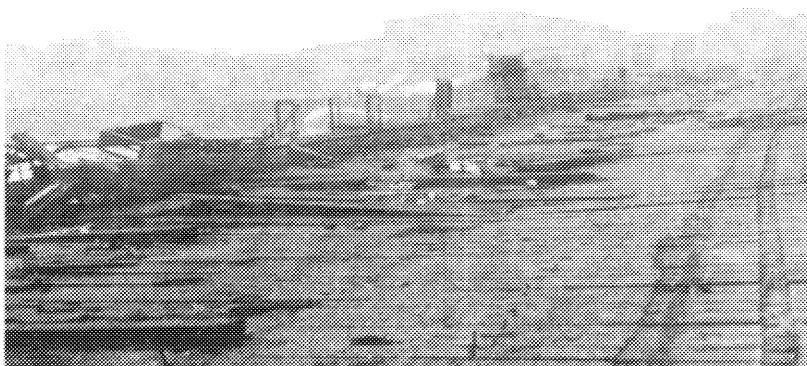
11. Warwick, Rhode Island. The bathhouse at Rocky Point was gutted.



12. Warwick, Rhode Island. The well-known Rocky Point Shore Dinner Hall was destroyed.



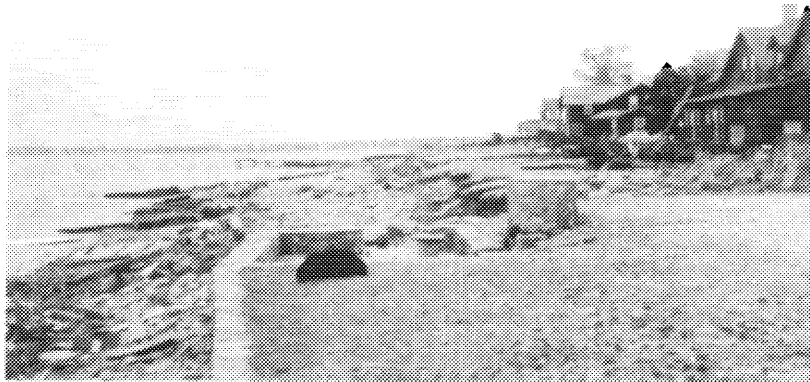
13. Warwick, Rhode Island. Conimicut Point cottages were wiped out.



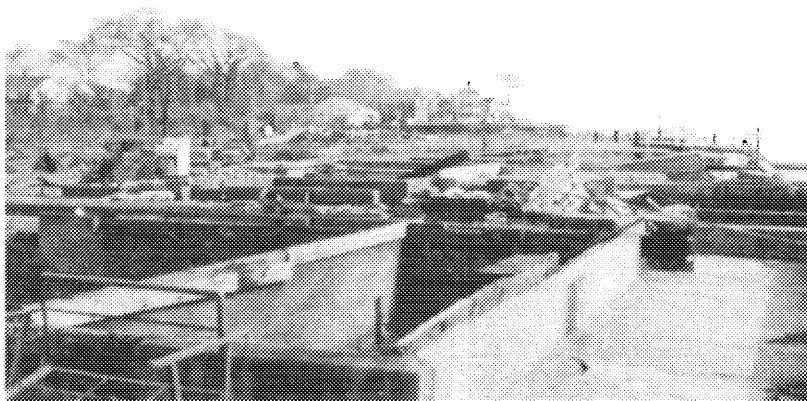
14. Providence, Rhode Island. Extensive pier and building damage occurred at Fields Point.



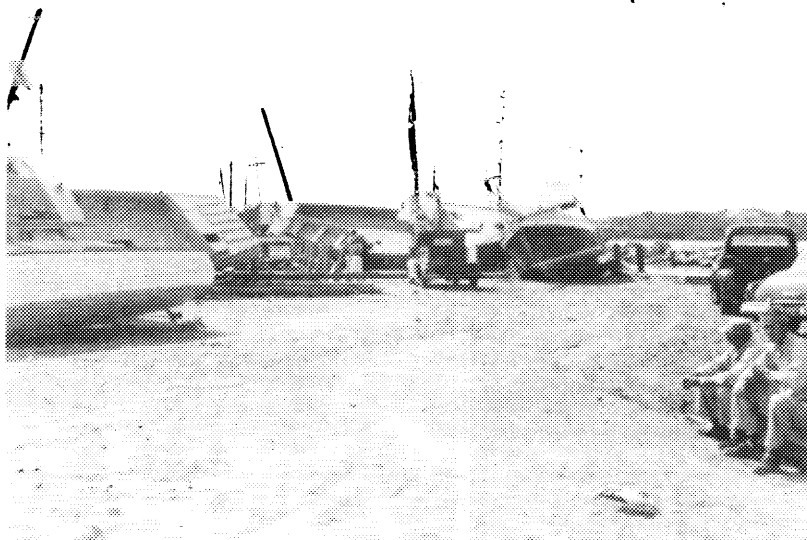
15. East Providence, Rhode Island. The bluff was eroded at Bullocks Neck and homes were destroyed, damaged or endangered.



16. Barrington, Rhode Island. Banks were eroded and houses were damaged at Rumstick Neck.



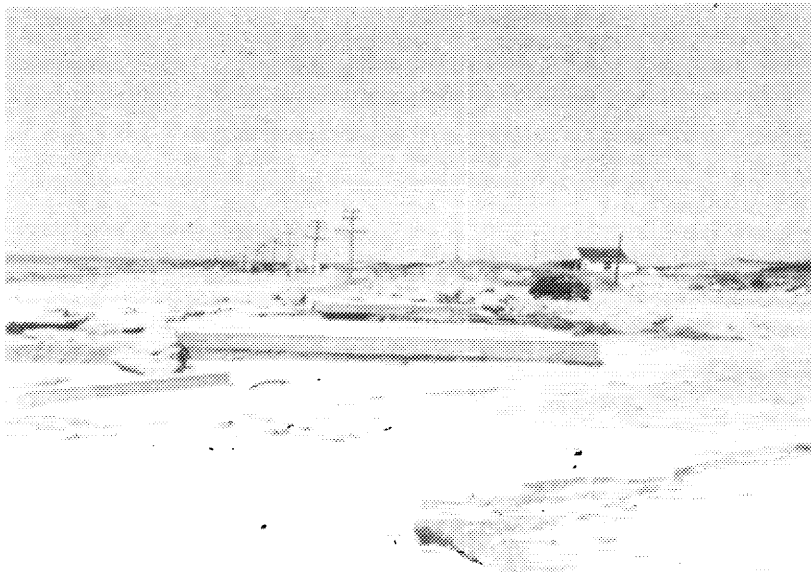
17. Barrington, Rhode Island. Sea walls and cottages were destroyed at Annawomscutt.



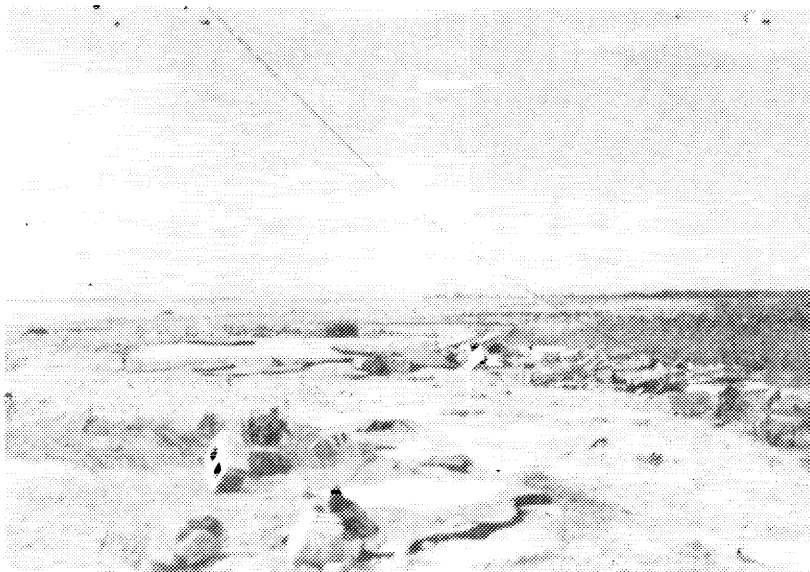
18. Westport, Massachusetts. Boats were left high and dry at Westport Point.



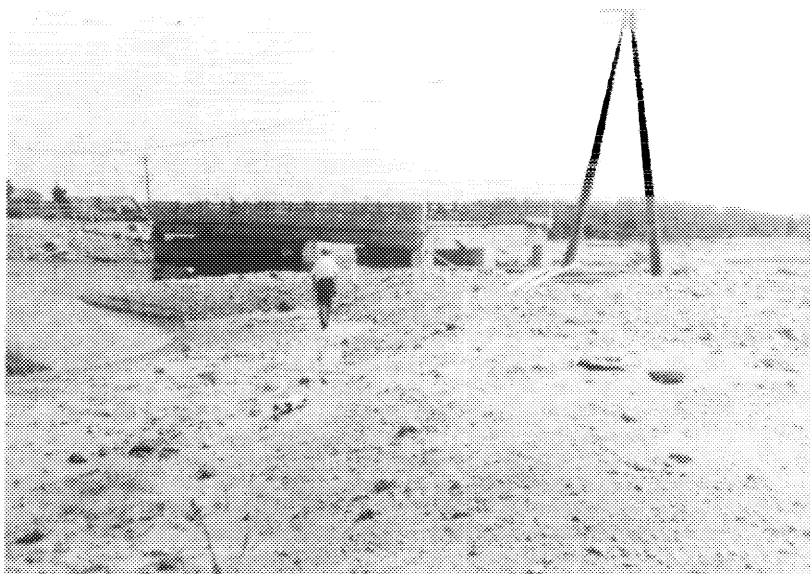
19. Westport, Massachusetts. Buildings were wrecked at the west end of Horseneck Beach.



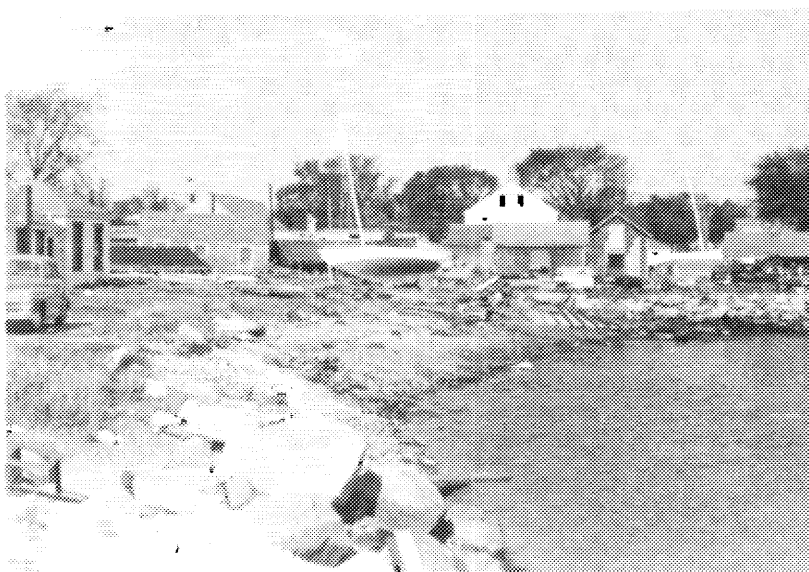
20. Westport, Massachusetts. Only foundations of cottages were left in the center of Horseneck Beach.



21. Westport, Massachusetts. East Horseneck Beach was swept clean of cottages.



22. Dartmouth, Massachusetts. Bridge approaches at Little River were washed out.



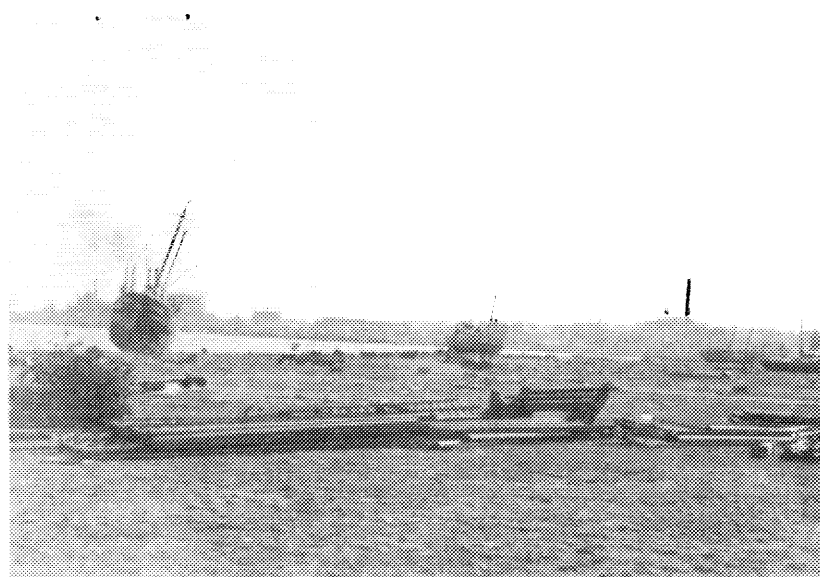
23. Dartmouth, Massachusetts. Boats were washed ashore and buildings destroyed at the Apponagansett River.



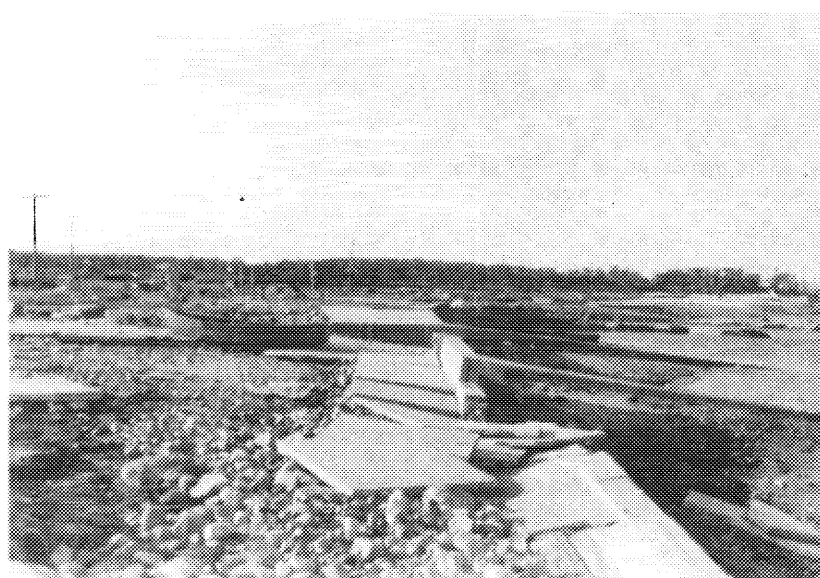
24. Dartmouth, Massachusetts. Boats, building wreckage, car, fallen trees and debris at the Apponagansett River typify hurricane damages.



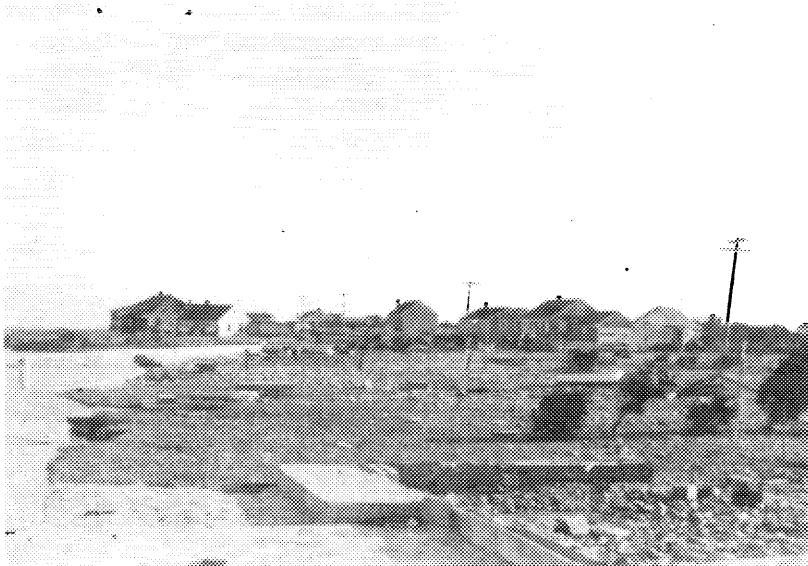
25. New Bedford, Massachusetts. Buildings were destroyed at Acushnet Park.



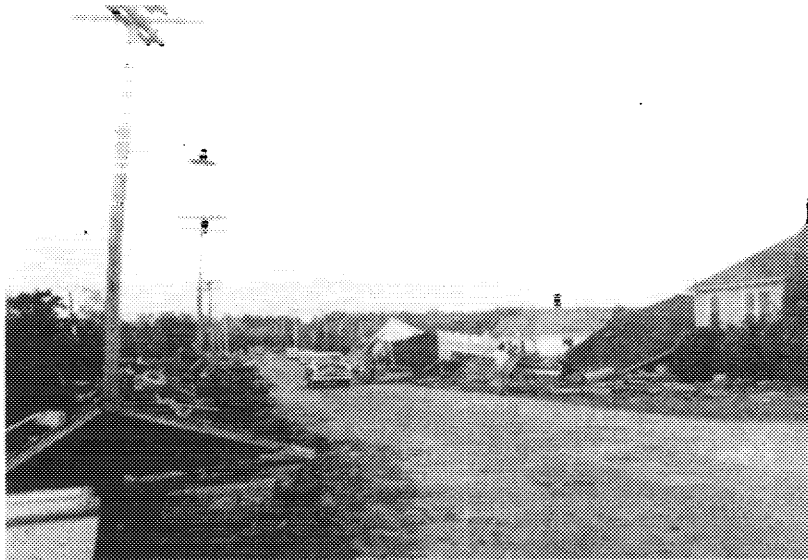
26. New Bedford, Massachusetts. Fishing vessels were left perched on Popes Island



27. Fairhaven, Massachusetts. Cottages were swept away at Sconticut Neck.



28. Fairhaven, Massachusetts. Only portions of cottage foundations remain at Sconticut Neck.



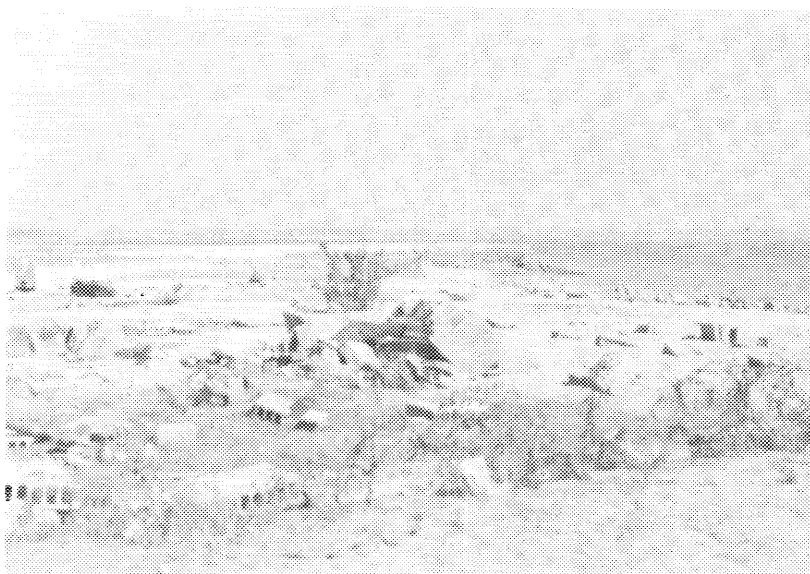
29. Mattapoisett, Massachusetts. Wreckage of the cottage colony at Crescent Beach lined the road.



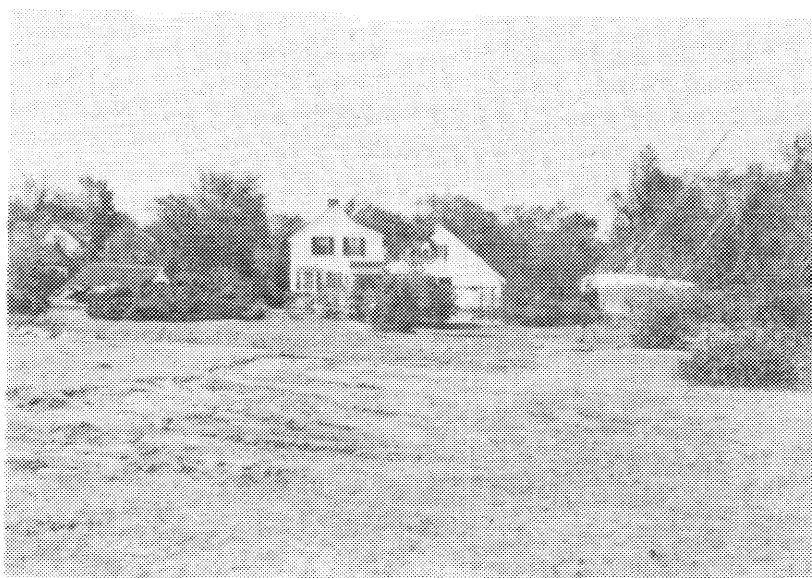
30. Mattapoisett, Massachusetts. A broad area at Crescent Beach was swept clean of cottages.



31. Mattapoisett, Massachusetts. Many boats were scattered about the shores of Mattapoisett Harbor.



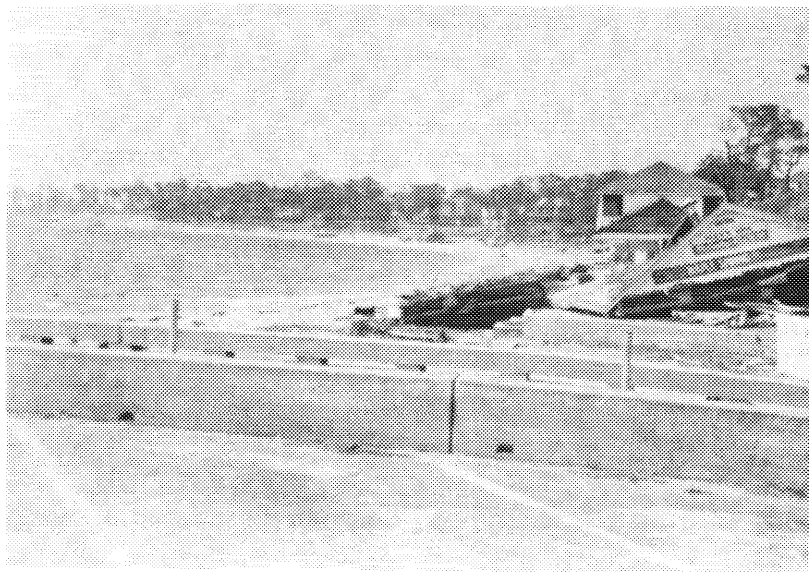
32. Marion, Massachusetts. Cottages were swept into the woods at Charles Neck.



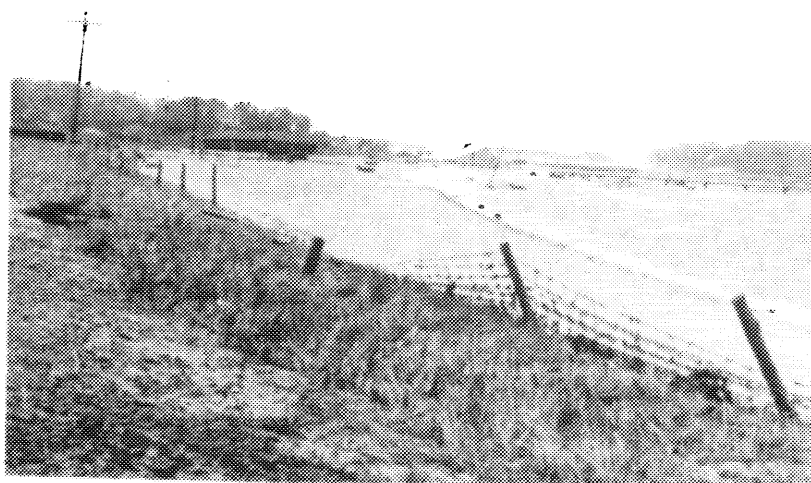
33. Marion, Massachusetts. Boats were swept ashore and residences damaged along Water Street.



34. Wareham, Massachusetts. Hundreds of cottages were destroyed in the Swifts Beach area.



35. Wareham, Massachusetts. Buildings were wrecked and boats were beached at Onset Bay.



36. Bourne, Massachusetts. A large building was demolished at Monument Beach.



37. Mashpee, Massachusetts. Banks were eroded and cottages damaged at Poponneset Beach.



38. Scituate, Massachusetts. Many pleasure craft were smashed against the rocks lining Scituate Harbor.